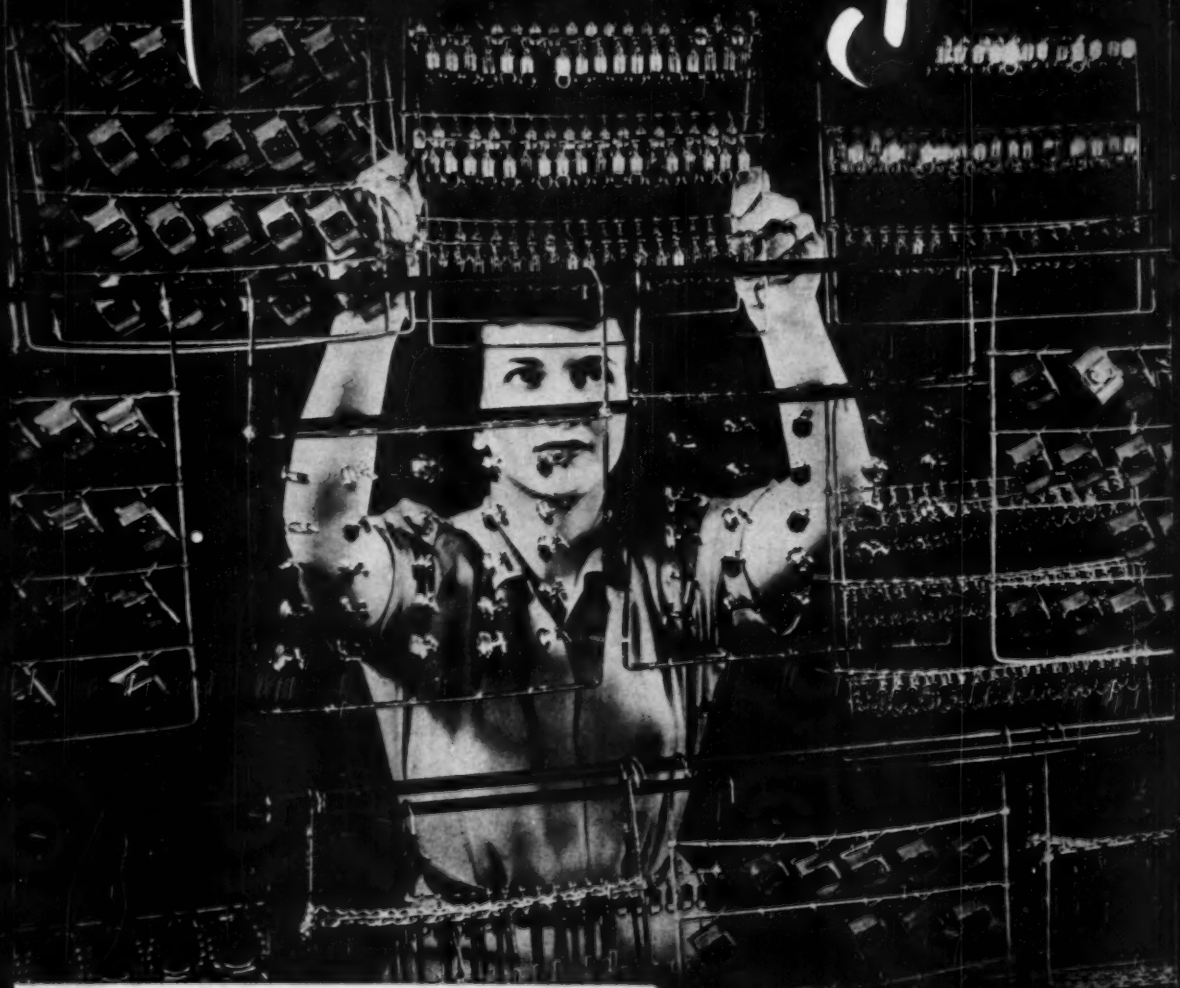
VOLUME 37
NUMBER 5

MAY, 1950

plating



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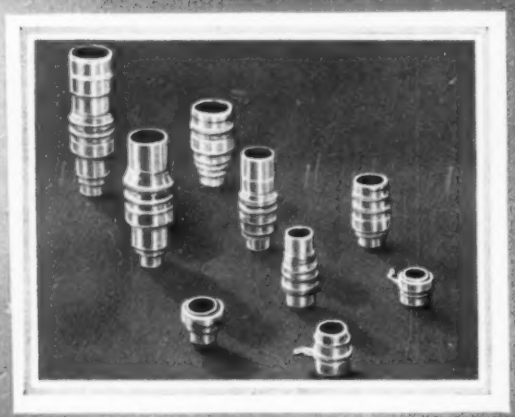

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This new booklet covers the subject of industrial grinding and finishing from all angles, through a series of "case histories" taken straight from the production line. Here's the aggregate of 3M's practical experience with belt grinding installations. 36 picture-filled pages showing how to step up your output and cut your unit cost by converting your present equipment to the 3M Method of Grinding and Finishing. Send for your FREE copy today!

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- Grinding and finishing brass and bronze
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- Sanding and smoothing woods and plastics
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- Stainless steel grinding and polishing
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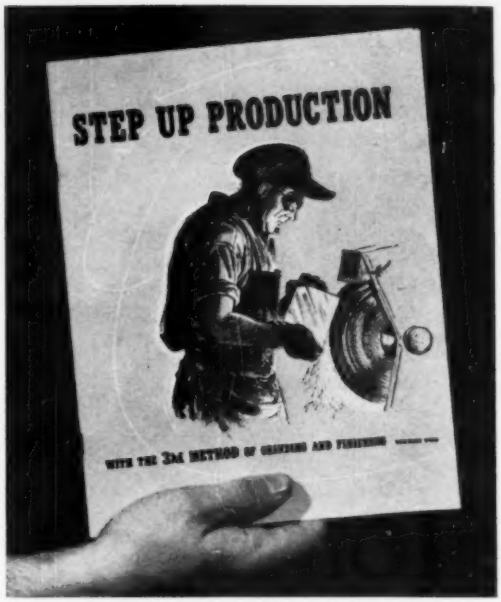

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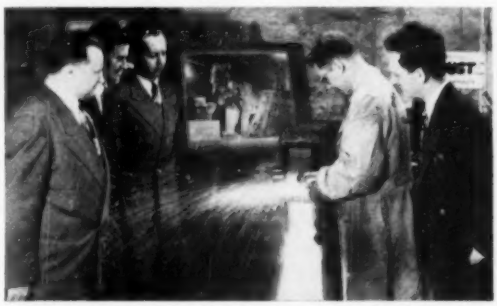

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Industry News

Imperial Plating Rack Company, Inc., has moved into enlarged quarters at 1613 Industrial Avenue, Flint, Mich., according to Mr. L. D. Faulman, Manager.

This new plant provides 4,000 sq. ft. or quadruple the floor area of the former plant. Racks as large as 10 feet in length and 2½ feet in width will be manufactured, and 10–14 day delivery can be made on any quantity of racks or insulation.

The Electric Products Company, Cleveland, Ohio, has appointed **Sheldon Storer and Associates** District Representatives for southwestern Ohio and the State of Kentucky. With offices in Cincinnati, Ohio, Sheldon Storer will be responsible for promoting the Company's line of motors, motor-generators, and electrolytic power supplies.

Bacon Felt Celebrates 125th Anniversary. Bacon Felt Company began in an old grist mill on the banks of the Aberjona River, which flows through Winchester, Mass., when Robert Bacon of Boston, a hatter by trade, purchased this old mill with its undershot water wheel and converted it into a felt mill. For a few years he continued at his old trade making felt hats, but later he added other felt products to his line such as wadding, saddle pads, slipper felts, and erasure felts.

The Company survived three bad fires, to say nothing of the periodic depressions to which the country has been subjected. In 1850, operations were moved to the present location, about a quarter of a mile.

In 1876 came a revolutionary change in the Company's objectives. Charles N. Bacon, grandson of the founder, perfected a method for making felt polishing wheels which he patented. Basically, it is the same method that is used today. Once the making of felt wheels or "hard felts" as they were then called had proved successful, the company discontinued consumer lines and concentrated production on felt wheels, sheet felt, and other industrial felts.

In 1932, after more than a hundred years in the hands of the Bacon family, the company was sold to new interests consisting principally of the present owners, Samuel S. McNeilly and Stanley N. McNeilly, who are President and Vice-President respectively. Samuel is in charge of manufacturing and wool purchases, Stanley of sales and sales promotion.

Published monthly at 5800 N. Marvine St., Philadelphia 41, Pa. Entered as second class matter July 1, 1946, at the Post Office at Philadelphia, Pa., under Act of August 24, 1916. Copyright, 1950, by the American Electroplaters' Society, Inc. Subscriptions: Domestic and Canada, $4.00 per year, 50c per copy; Foreign, $6.00 per year, 75c per copy.

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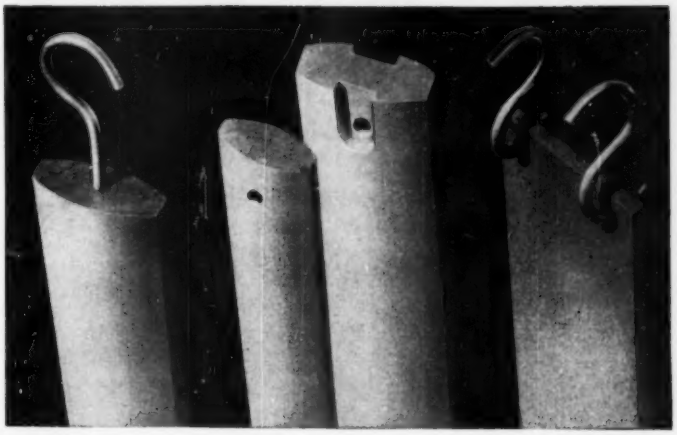
means purity in copper anodes



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In addition to copper, ANACONDA Anodes are furnished in brass and bronze . . . rolled sheet or oval . . . cut to your own specifications or standard sizes . . . drilled or undrilled . . . with or without hooks—also copper "cathode-anodes". For present or future reference, write for Publication C-5, The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

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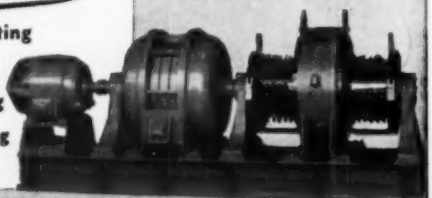

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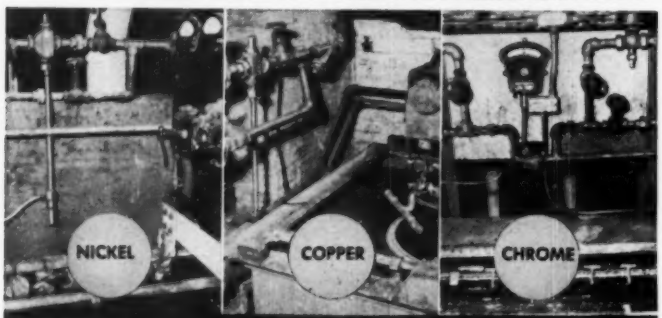

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Stanley McNeilly Samuel McNeilly

Shortly before World War II the company brought out a line of bobs and small wheels for finishing small contoured parts. So it was only natural that, during World War II when the airplane became so all important, the company was called upon to supply the airplane and parts industries with large quantities of small bobs and wheels of many shapes and sizes.

The McNeilly interests established a laboratory for testing wool, better production methods and new uses for wheels and bobs. From this laboratory have come new products, such as mandrel-mounted bobs and the line of hair felts used in the glass manufacturing field.

Recently the company purchased a one-story 50,000-sq.ft factory in Taunton, Mass., which is about twice the size of the present plant in Winchester. New processing machinery has been designed and when completed will be installed in the new factory. Plans call for gradual shifting of production during the latter part of 1950 so that there will be little loss of time. By 1951, it is expected that the changeover will be completed and all production will be carried on in the Taunton factory. Present employment consists of approximately fifty men and women. It is expected that close to one hundred employees will be needed in Taunton.

The brand name Paramount Brand established in 1932 will be carried along to Taunton, of course; and all felt products produced by Bacon Felt will continue to carry that brand name.

Barrel Finishing Development Service. The recently enlarged Engineering and Development Department of Almco Supersheen, Albert Lea, Minn., has added a new service for the purpose of solving special barrel-finishing problems for all manufacturers. This service, in most instances done without charge, includes not only development of finishing procedures and techniques, but also special research and development on automatic handling, automatic separating, hoisting, etc.

Letters of inquiry are invited. Wherever possible, the manufacturer is requested to outline his problem, whether it be finishing, handling, or separating.

"Tests prove there's none better-- figures show it costs you least"

*Special trial order packaging

Exhaustive tests have proved that ARP #3 zinc plate brightener in barrel, still or automatic zinc plating gives you increased brightening range and a smooth, controllable, bright deposit of zinc second to none. The price of ARP #3 is well below that of any other zinc brightener of even satisfactory quality. The ease of handling and flexibility of operation reduce operating costs to make additional savings for you. For your own satisfaction, ask your Allied representative for full information and comparative cost breakdown . . . or, write for literature and 10 lb. trial order.

Use ARP #3 Plus IRIDITE® Bright For A *Lasting* Finish

For a lasting, brilliant and lustrous finish—combined with corrosion resistance—use Iridite Bright after bright zinc plating. This chromate-type finish requires only a simple dip—no heating, non-electrolytic—is efficient and inexpensive. Ask your Iridite representative.

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Manufacturers of IRIDITE Finishes for Corrosion Resistance and Paint Systems for Non-Ferrous Metals: ARP Plating Chemicals

Industry News

In the event it is necessary, Almco will place a qualified engineer at the disposal of the manufacturer for an on-the-spot analysis of the problem.

The First British Industrial Finishes Exhibition, to be held at Earls Court from August 30 to September 7, will lay emphasis on metal finishes, although other finishes are not excluded and quite considerable space will be devoted to paint and wood.

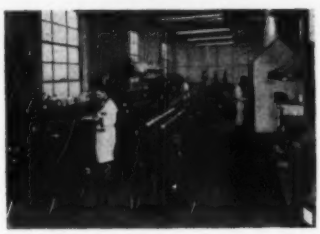
Catering to both large and small firms, the Exhibition is expected to be the finest and most comprehensive display by manufacturers of industrial finishing processes that Britain has ever seen. At the Exhibition the manufacturer will be able to see the wide range of finishes which are available to him. He will, too, be able to obtain expert advice as to the best kind of finish for his particular product, having regard to selling price and suitability to varying climates in export markets in the dollar and sterling areas. It is hoped that this Exhibition will help to close the gap between the laboratory and the manufacturer which sometimes puts the British manufacturer at a disadvantage compared with his American rival.

Most Abrasive Grain manufactured by The Carborundum Company, Niagara Falls, N. Y., was standardized as to number of types, number of combinations of grains, and number of grain treatments during 1949, according to the company's annual report. The standard product can be made with better manufacturing controls insuring greater uniformity and more adequate stocking, it is said.

Schaefer Brush Manufacturing Company, one of the nation's largest manufacturers of industrial brushes, has instituted a new Brush Research and Development Division to help users of brushes to solve their cleaning problems. The Division, if necessary, will send an engineer to the job for first-hand information. However, in most cases, by merely sending the cleaning problem with proper information to Schaefer, the inquirer will receive recommendations for a brush suitable to solve his problem.

United Chromium, Incorporated, Builds New Research Laboratories. Included in the firm's new quarters at 1700 E. Nine Mile Road, Detroit, Mich., are research and analytical laboratories of the company's electroplating division and a pilot plant.

Research Laboratory



Analytical Control Laboratory equipped to handle up to 100 analyses per day

The research laboratories have been set up along the unit principle with a separate laboratory provided for each research function. Five such fully equipped laboratories have been provided. By following this principle, the company is able to carry out many independent research activities simultaneously without having them conflict with each other as a result of limited working space or facilities. An intensified research and testing program on the company's complete line of Unichrome plating processes and materials has been scheduled.

The Martin Dennis Company, producer of chromium chemicals and a wholly

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Company .....

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City ..... State .....

P-9 50

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

owned subsidiary of Diamond Alkali Company with plants at Newark and Kearny, N. J., became an operating division of Diamond January 1. The Martin Dennis Company was organized in 1893 as a New Jersey corporation and was purchased by Diamond in March, 1948.

American Society for Testing Materials will hold its 53rd Annual Meeting in Atlantic City during the week of June 26. Also scheduled is the Ninth Exhibit of Testing Apparatus and Related Equipment and the Society's Biennial Photographic Exhibit.

Committee B-8 on Electrodeposited Metallic Coatings will not meet at this time but, with its subcommittees and working sections, will hold meetings at the time of the Fall Meeting of The Electrochemical Society in Statler Hotel, Buffalo, N. Y., October 11–14.

Plating Industry Statistics

The American Electroplaters' Society and the National Association of Metal Finishers, organization of job platers, are each organizing committees to assemble much needed statistics about the plating industry: number of plating plants, number of employers, plating facilities, etc.

The A. E. S. Committee is headed by Past President S. S. Johnston of Weirton Steel Company, Weirton, W. Va., the N. A. M. F. Committee by Henry J. Bock of Auto City Plating Company, Detroit. The two committees will cooperate closely.

An International Electroplating Symposium was held on March 9 in Dusseldorf, Germany, under the chairmanship of Friedrich Blasberg.

Wyandotte Chemicals' top selling "team", J. B. Ford Division, are left to right: R. J. Racine, Technical Service Department; Dr. Roy E. Heath, Manager of Market Development, Industrial Detergents; Robert L. Reeves, newly appointed General Sales Manager; F. H. Tholen, Assistant General Sales Manager

Papers were presented by F. van der Graff of The Netherlands on "New Electroplating Methods—Anglosaxon Development during the Past 15 Years"; A. Smart of England on "Automatic Plating Plants"; Karl Sommer of Germany on "The Possibilities of Adjusting the German Metalworking Industry to Modern Production Methods"; and A. Hock, of The Netherlands on "Specifications and Costing in Electroplating".

The Fifth National Instrument Conference and Exhibit will be held in the Memorial Auditorium, Buffalo, N. Y., September 18–22, 1950.

Five days of technical sessions will be conducted in the Auditorium in connection with the Conference by the following societies: The Instrument Society of America, American Institute of Physics, Industrial and Regulators Division of the American Society of Mechanical Engineers, Institute of Radio Engineers, Instruments and Measurements Committee of the American Institute of Electrical Engineers, and National Telemetering Forum.

The Instrument Exhibit will occupy 15,500 sq.ft and will include scientific and industrial instruments and devices for measurement, inspection, testing, and automatic control. Seventy-five hundred visitors are expected. In the first thirty days of the sale of space, 108 of the 165 booths available were reserved.

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Industry News

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A.E.S. Research Fellow with M.S. degree from Michigan State College desires employment in research, development, or control. Major in Physical Chemistry, minors in Metallurgy and Analytical Chemistry. Any locality.

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Graduate Chemical Engineer with experience in making up, controlling, analyzing, and electroforming with iron, copper, nickel, and silver; and plating with gold, rhodium, palladium, platinum, chromium, etc., solutions for manufacturing phonograph record stamper matrices, radar wave guides, slosh molds, paint masks, parabolic mirrors, etc., is seeking an administrative position in or around North New Jersey or Metropolitan area.

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McKEON'S

Zinc-Brite

world's newest cleansing and purifying agent for zinc plating solutions. Free samples and unlimited cooperation.

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Greensburg 8, Pa.

Personals

Buckingham Products Appoints New Sales Representatives. Buckingham Products Company announces the appointment of **R. O. Blackford,** 1336 Calvin, S. E., Grand Rapids, Mich., as Sales Representative for its Polishing and Buffing Compositions and Foundry Supplies in the Grand Rapids district.

Pietrowicz

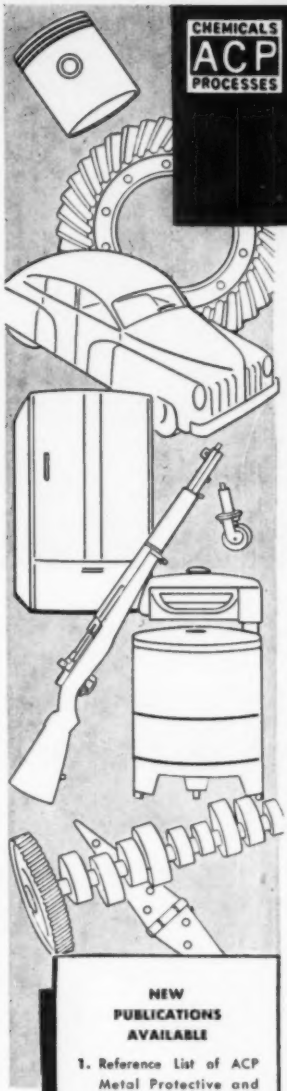
A. L. Pietrowicz has been appointed Sales Manager of The Prozite Company. He was formerly Vice-President of Chicago Plating Company and is a member of the American Electroplaters' Society, the Electrochemical Society, and the National Association of Corrosion Engineers.

Cliff L. Ricketts has joined Charles F. L'Hommedieu & Sons Company, Chicago as a Chemical Engineer. He will be available to anyone requiring information about electroplating problems.

Tholen

F. H. Tholen has been promoted to Assistant General Sales Manager of the J. B. Ford Division of Wyandotte Chemicals Corporation. Born in 1902 in New York City, he joined the J. B. Ford Company in 1929 after having been educated at the United States Naval Academy, Brown University, and the Babson Institute of Business Administration.

Service in the company's package and advertising departments preceded a period of partnership in a grocery brokerage firm in Detroit in the early 40's. Afterward he returned to the company, first as Seattle District Manager, then as Assistant Manager of the household products department, and until now as Manager of the department handling the sale of bulk products in small size units.



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"Thermoil-Granodine", a manganese-iron phosphate coating chemical, forms on steel a dense crystalline coating which, when oiled or painted, inhibits corrosion.

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The oiled **"Thermoil-Granodine"** coating on pistons, piston rings, cranks, camshafts and other rubbing parts, allows safe break-in operation, eliminates metal-to-metal contact, maintains lubrication and reduces the danger of scuffing, scoring, galling, welding and tearing.

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"Granodraw" forms on pickled surfaces a tightly-bound adherent, zinc-iron phosphate coating which facilitates the cold mechanical deformation of steel, improves drawing, and lengthens die life.

Write or call for more information on these products, and advice on your own metal-working problem.

NEW PUBLICATIONS AVAILABLE

1. Reference List of ACP Metal Protective and Paint-Bonding Chemicals.
2. ACP Phosphate Coating Chemical Selection Chart.
3. ACP Phosphate Coating Chemical Descriptive Folder.

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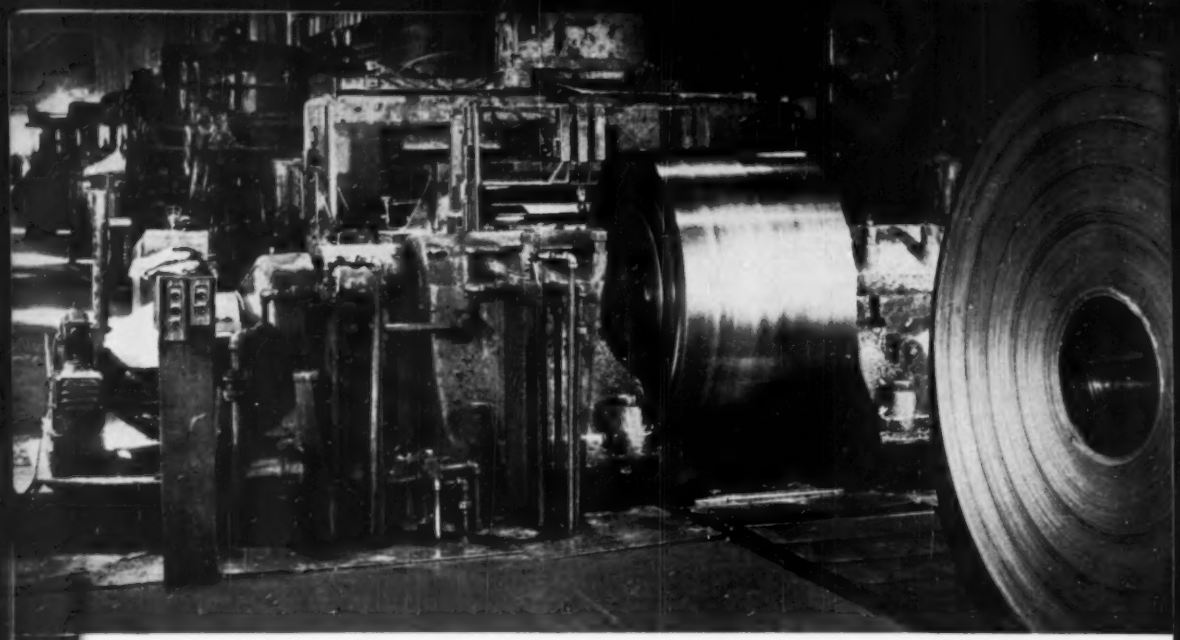
Manufacturers of Metallurgical, Agricultural and Pharmaceutical Chemicals

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 332.



Entrance end of cleaning line at Weirton Steel Company, Weirton, W. Va. Steel whizzes through line at about 1500 feet per minute. Note streaky, soiled appearance of roll mounted on mandrel.

Every day is wash day in this giant tin mill ... steel comes clean in seconds with PENNSALT CLEANER

In Weirton's tin plating operations—as in most other tin mills in America—strip steel gets a Pennsalt metal cleaner bath prior to plating! There must be reasons, and here they are:

Pennsalt alkaline cleaners—which prepare the steel for plating—were developed to meet actual plant conditions. As a result, rejects due to faulty plating caused by dirty steel are held to an absolute minimum.

Pennsalt cleaners are anhydrous—you don't pay for excess water. On top of that, most of these cleaners are fused mixtures, giving you a uniform solution every time you make up a new charge.

And that's not all! Whether you use Pennsalt cleaners prior to electroplating, porcelain-enameling, anodizing, or painting—you can be sure of getting top quality at low cost per pound. Why? Because Pennsalt produces its own alkalies—manufactures its cleaners right from the ground up. As a *basic* producer of chemicals for 100 years, Pennsalt is known for its high-grade products, with prompt delivery at a fair price.

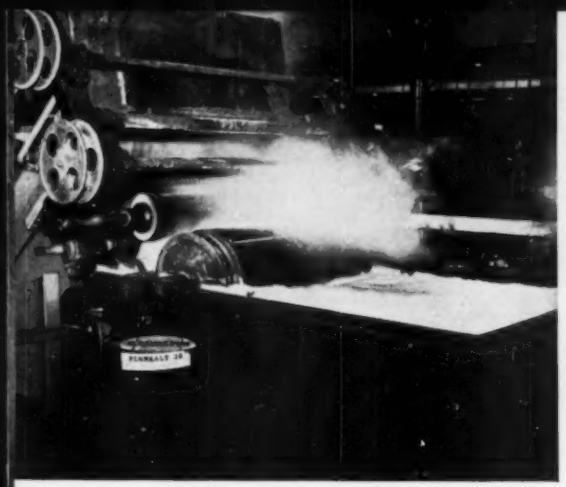
Pennsalt's extensive research facilities are at work constantly . . . testing . . . experimenting . . . improving. The main objective of our scientists and technicians is to continue to provide you with the most effective cleaning compound you've ever used.

Get the benefits of Pennsalt experience in the metal cleaning field. Just call in a Pennsalt metal cleaner expert . . . he'll be glad to help you with your problems. Special Chemicals Department, Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa.

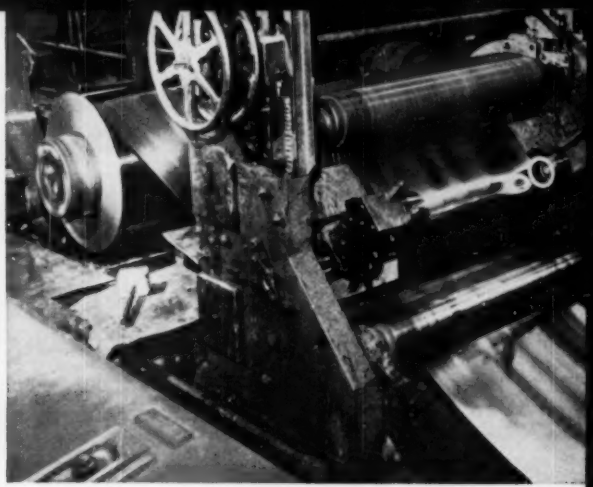
PENN SALT

metal cleaners

PROGRESSIVE CHEMISTRY FOR A CENTURY



Dip and scrubber tank, where Pennsalt cleaner is used. This operation is typical of efficient Weirton method. Pennsalt #30 has to get steel clean in just about two short seconds.



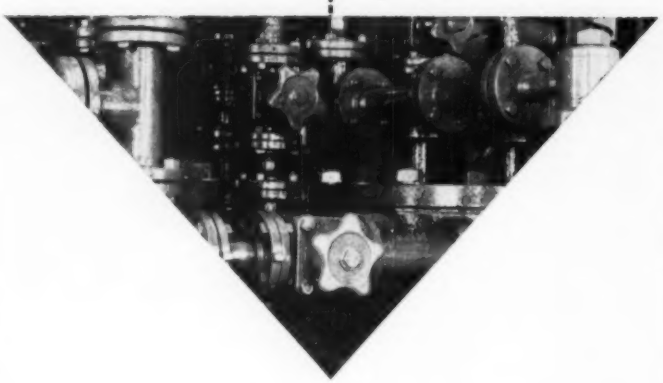
Tension rolls and rewinding mandrel. Steel is so well cleaned that fin masher and lower guide roll are reflected on strip. There is no indication of smut build-up on guide rolls.

View of Weirton plant from exit end of cleaning line. Coil on weighing scale shines brilliantly, as does steel passing down into looping pit. Weirton, through use of Pennsalt cleaners, does excellent cleaning job.

SARAN
LINED
steel
pipe

means dependable protection

against corrosion!



For the dependable protection against corrosion that assures you of long-term operation at a minimum maintenance cost—*specify saran lined steel pipe.* Saran's unusual resistance to most chemicals and solvents plays an important part in the reduction of shutdowns and lost production. Another noteworthy advantage is its ease of field fabrication—involving NO costly delays with special tools or handling. Saran lined steel pipe is available in maximum lengths of 10 feet and in sizes from 1 to 6 inches. Also available are saran lined diaphragm valves, plug valves, flanges, reducing flanges, flanged fittings, gaskets and fittings with union ends. Manufactured by The Dow Chemical Company, Bay City, Michigan, distributed by Saran Lined Pipe Company, Dept. TSP-25.

Distributed by
Saran Lined Pipe Company
701 STEPHENSON BUILDING • DETROIT, MICHIGAN
Offices in: New York • Boston • Philadelphia • Pittsburgh
Chicago • Tulsa • Indianapolis • Houston • San Francisco
Los Angeles • Portland • Cleveland • Denver • Seattle
Charleston, S. C. • Toronto

SARAN LINED PIPE
a
DOW
product

Personals

Dr. Francis C. Frary, Director of Research, Aluminum Company of America, was awarded the James Douglas Metallurgical Medal for 1950 by the American Institute of Mining and Metallurgical Engineers at its 79th Annual Banquet in Hotel Statler, New York City in February.

The award was presented "for distinguished achievement in science and contribution to society by broadening the field of knowledge in all phases of the aluminum industry and for notable success in directing a vast research project in this industry".

Among the many achievements of the medalist, two of the most outstanding include the production for the first time of very pure aluminum (99.99 per cent) by electrolytic refining and the production of pure alumina by electrothermal processes. He holds some thirty United States patents and is the author or co-author of numerous books and papers in the fields of metallurgical and chemical research.

Kurdenak

John Kurdenak was recently appointed Vice-President in charge of sales of Standard Plating Rack Company, Chicago, Ill. During the last three years he has been the firm's plant superintendent, and he will continue to be responsible for production and plating rack development.

Before his association with Standard he gained wide experience in the plating field with Houdaille-Hershey Corporation, Chrysler Corporation, and General Mills, Inc.

Harold J. LaCasse has joined Pennsylvania Salt Manufacturing Company's Special Chemicals Department as field sales service representative in the Indiana territory. He takes over the territory relinquished by **John C. Hampson** when he recently became Sales Manager of the department's newly formed Chicago district.

Mr. LaCasse comes to Pennsalt from the Stewart Warner Corporation of Chicago, where he was a material specifications engineer. Previously he was associated with General Electric and Eastman Kodak in electroplating and metal-finishing operations. He was graduated from the University of Rochester as an industrial engineer. He is at present living in Indianapolis.

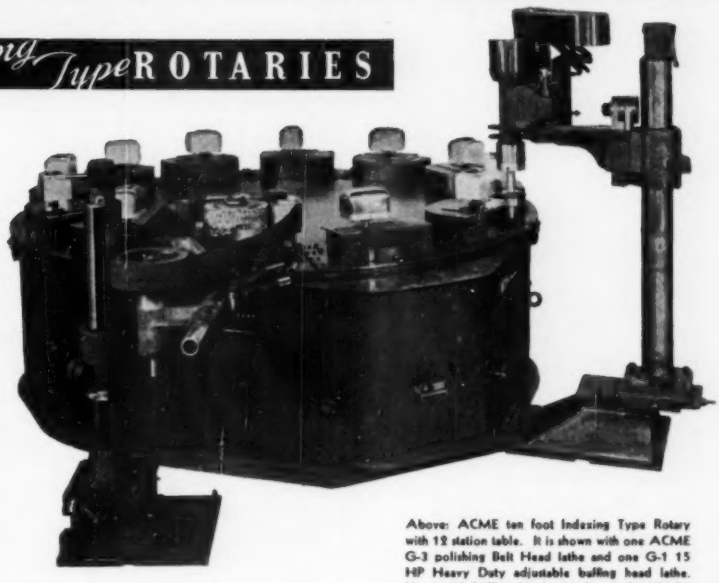
FOR HIGH PRODUCTION POLISHING and BUFFING

ACME Automatic POLISHING and BUFFING MACHINES

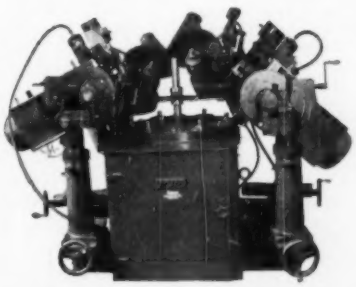
ACME Indexing Type ROTARIES

ONE SECOND INDEXING TIME BETWEEN STATIONS

One second indexing time is a standard feature of all ACME Indexing type Rotaries. Output can be standardized at high levels with uniform finish. Dwell time of wheel on work can be controlled while indexing time between stations is held to the one second interval.



Above: ACME ten foot Indexing Type Rotary with 12 station table. It is shown with one ACME G-3 polishing Belt Head lathe and one G-1 15 HP Heavy Duty adjustable buffing head lathe. Up to 11 buffing heads can be used with this machine with one loading and unloading station. Up to 10 heads can be used with 2 loading and unloading stations opposite each other giving the equivalent of two 5 head machines.



Left: ACME 30 inch, six station Indexing Type Rotary using four ACME Adjustable floating head polishing and buffing lathes. It is equipped with a special hold down tail stock and air lift on heads synchronized with indexing table. This machine is adaptable to many cost cutting arrangements.

ROTARY STRAIGHT LINE SEMI-AUTOMATIC AND SPECIAL Polishing and Buffing Machinery

(Catalogues on request)

SPECIAL MACHINERY — AUTOMATIC BUFFING MACHINES

ACME Manufacturing Co.

1645 HOWARD ST. DETROIT 16, MICH.

Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 335.

SEYMOUR
ANODES

HELP YOUR PLATING PROBLEM

When excessive sludge, peeling, porosity and brittle deposits spoil your work, start clean with new Seymour Anodes — Anodes you can depend on for consistently excellent results. Our well-equipped laboratory and experienced staff are at your immediate service for analyses and tests, at no obligation whatsoever.

A HANDY LIST OF SEYMOUR ANODES

99%+ *Rolled Depolarized* — A very fine, homogeneous, even-grained virtually pure nickel anode. Corrodes in hot or cold solutions with minimum metallic loss. Forms practically no sludge. Especially suitable for baths having a pH above 4.5 electrometric.

99%+ *Rolled Carbon*—A rolled anode of high efficiency for low pH hot Watts baths not above 4.5 electrometric. Corrodes smoothly with a minimum of loose nickel.

99%+ *Cast Carbon* — A pure nickel anode with carbon content adjusted for smooth, uniform corrosion without special controls. Available, however, with carbon content to meet any specifications. Adaptable for general shop work using hot or cold baths.

95-97% *Sand Cast* — Corrodes readily in solutions low in nickel or weak in salts — therefore suitable for cold, high pH, low current density plating solutions. Uniform corrosion throughout the life of this anode is obtained by an even distribution of the carbon content. A 90-92% Sand Cast Seymour Nickel Anode is also available.

"Seycast" — An improved type of 99%+ cast anode of very high efficiency designed primarily for Bright Nickel baths, but works perfectly in any hot Watts bath having a pH of 4.5 electrometric or lower. Corrodes evenly with practically no loose nickel formation, due to long, interlocking grains radiating from a common center. Especially suitable for high current densities.

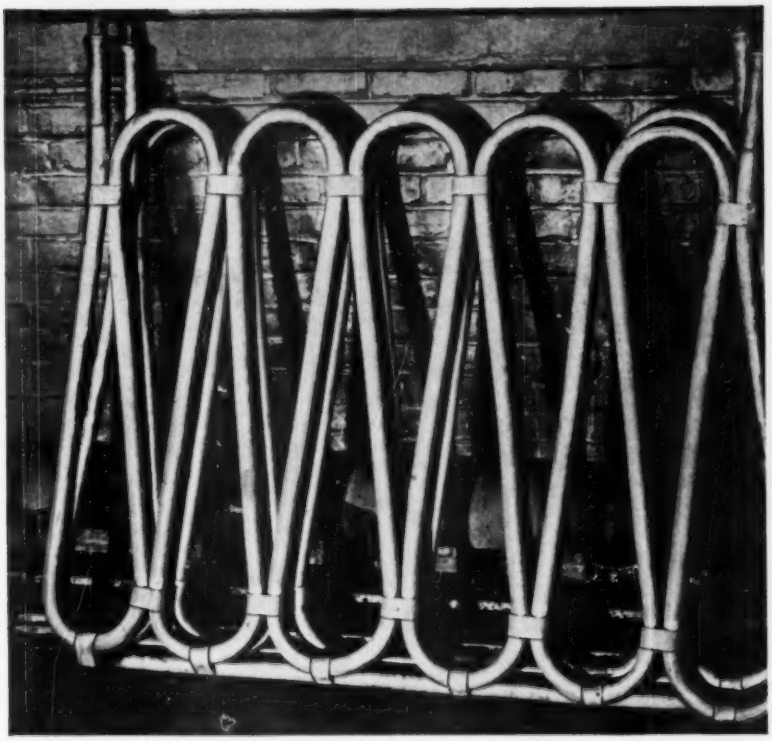
Bright Nickel — A hot organic type process free from promoter metal, stable and easily controlled. Produces brilliant deposits from a standard hot nickel bath without the usual colering or buffing. Excellent throwing power, wide operating conditions. Free from wetting out agents.

OTHER ANODES — Seymour Anodes in all shapes to meet rigid specifications are also available in copper, brass, bronze and zinc. The copper used is electrolytic. The zinc is always the best grade obtainable.

"Seycast"

THE SEYMOUR MANUFACTURING COMPANY, SEYMOUR, CONNECTICUT

SEYMOUR



Coils and linings of Nalco Metal last longer because their lead chromate "armor" stays on.

new

lead alloy with extra resistance in chromic acid nalco metal

Reg. U. S. Pat. Off.

Here's a new lead alloy specifically designed for longer life in chromic acid solutions.

It's NALCO METAL, developed and made by the leader in lead and lead alloys—National Lead Company.

Extra resistance explained

Secret of NALCO METAL'S longer life in chromium plating plants proved by many practical tests) is its ability to retain the protective coating of lead chromate which forms on the metal when in contact with chromic acid.

With alloys previously used, the lead chromate coating formed, failed and re-formed in unending cycles of disintegration.

NALCO METAL stays on the job because the lead chromate stays on the metal. No need of anodic treatments of coils and linings when they're made of NALCO METAL.

All of lead's workability retained

Sheets of NALCO METAL can be readily cut and shaped to fit any tank . . . and joints can be inseparably burned. In pipe form, NALCO METAL can be coiled or bent to form units of any size or shape. Anodes can be made for any type of plating operation.

Whether you do hard or decorative plating, you'll want more information on NALCO METAL as it applies to your operations. Get in touch with our nearest office.

Note the Difference

After six months' immersion in standard chromic acid solution, the Nalco Metal test strip at right shows virtually no corrosion. Note corrosion of 6% Sb lead strip at left.

NATIONAL LEAD COMPANY

111 Broadway, New York 6, N. Y.

Dutch Boy PRODUCTS

Reg. U. S. Pat. Off.

Offices and Plants in Principal Cities; Pacific Coast: Morris P. Kirk & Son, Inc., Los Angeles; Canada: The Canada Metal Company, Ltd., Toronto.

Emlon is STABLE in water alkali acid

Have you tried Wyandotte Emlon? It has been used successfully for cold cleaning in spray washers. It can eliminate hazardous solvents in the pre-soak tank when a pre-clean is necessary to remove heavy soil and buffing compounds. It can be added to acid and alkali cleaners to increase cleaning efficiency. It can be added to finishing and removing compounds to facilitate their removal in later operations.

Emlon is a liquid that combines organic solvents and several emulsifiers. The solvents contribute high boiling characteristics . . . assure long-lasting solutions. The emulsifiers, because they are soluble in oil and water, remove inorganic as well as organic soil. Because these emulsifiers produce unusually stable emulsions instantaneously, you get better and faster cleaning action, longer solution life and lower cleaning costs.

Why not write for a sample?

WYANDOTTE CHEMICALS CORPORATION
Wyandotte, Michigan
Service Representatives in 88 Cities

Wyandotte
REG. U. S. PAT. OFF.

Personals

Critchfield

L. A. Critchfield is now Director of Chemical & Metallurgical Laboratories of Standard-Thomson Corporation, Dayton, Ohio, and Manager of its Quality Control Department. He was previously with United Chromium, Incorporated in the same city and before that with Hamilton Watch Company, Lancaster, Pa. Mr. Critchfield is a very active member of the Dayton Branch of the American Electroplaters' Society.

Lawrence Stockwell, Detroit and **David Stockton,** Chicago, made over a million dollars in total sales during 1949 for The Udylite Corporation, it was announced at the firm's annual national sales convention in Detroit recently.

Eight salesmen received half-million dollar plaques. They were **Louis Minbiole,** Detroit; **William Moyer,** Philadelphia; **Vince Kelly,** Indiana representative; **Joseph Hoefer,** Detroit; **James Clifford,** New York; **Harvey Zens,** Detroit; **James Fitzgerald,** Detroit, and **Ed Stack,** Chicago.

Sloane

Perry Sloane has joined the sales force of M. E. Baker Company, Cambridge, Mass. Following graduation with an A.B. degree from Columbia University in 1936 and graduate studies in chemistry at Ohio State University, he was employed by Oakville Company, Division of Scoville Manufacturing Company between 1941-1944, first as chemist and then as finishing foreman. From 1944 to 1948 he served with Benrus Watch Company, Waterbury, Conn., as Chief Chemist in charge of all finishing operations, and has since been engaged as private consultant on plating problems. Mr. Sloane will travel Rhode Island and southern Massachusetts, particularly in the jewelry centers.

MURRAY WAY #50 UNIVERSAL HEAD

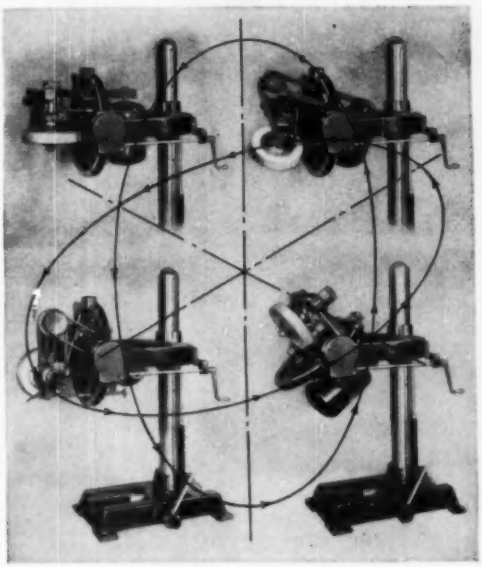
These extremely versatile polishing and buffing heads are first choice wherever finishing of flat or irregular shapes is required. The M-W®50 is only one of our standard-built, full-floating, pedestal-type heads for use in combination on continuous or indexing rotaries; or with straight-in-line or semi-automatic machines.

Our thoroughly experienced engineers will also design and build special automatic polishing or buffing equipment to your exact requirements.

Your inquiries are invited.

MAJOR IMPROVEMENTS PIONEERED BY MURRAY-WAY

- **FULL-FLOATING HEAD.** Assures uniform working pressure.
- **ADJUSTABLE FULCRUM.** Permits adjustment in compound angles.
- **VARIABLE, SELECTIVE DWELL.** Two seconds to two minutes.
- **AUTOMATIC BELT CONTOUR-FINISHING.**
- **MICRO POLISH PROCESS**—prepolishing before forming.
- **VENTILATED BUFFING WHEELS.**



360° Both Axes Simultaneously

MURRAY WAY

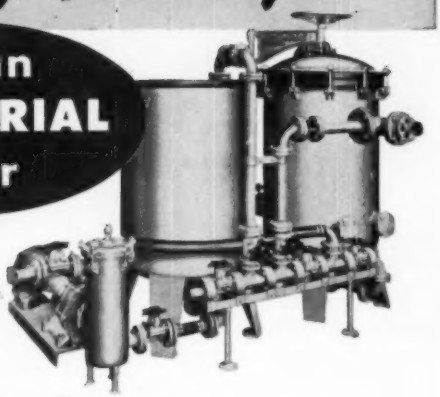
THE MURRAY-WAY CORPORATION

3925 WEST FORT STREET • DETROIT 16, MICHIGAN

AUTOMATIC POLISHING, BUFFING, GRINDING EQUIPMENT

For Any Plating Solution
Any Quantity

use an INDUSTRIAL Filter



100 to 15,000 gallons per hour. Portable and stationary models. Standard or special filtration systems engineered to meet unusual requirements.

You save many ways . . .

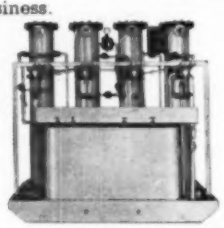
Here's how Industrial filters keep down the cost of plating jobs—The flow rates of Industrial filters are based on the actual plating solutions involved. You know the capacity you get. In the filtration of plating solutions there is more than just the filter. With Industrial you get an adequate filter with slurry tank, motor driven pump, valves and fittings in a complete package with one, undivided, experienced responsibility—with space requirements at a minimum.

The labor, down time, and the inconveniences of cleaning, replacing the filter media, and reassembling the filter for every new filter cycle—all are eliminated by the Industrial Air-Wash Cleaning Method available for all models. It is necessary to remove the cover only when new filter cloths are installed. With Industrial filters, a clarified plating solution is always assured.

The engineering, design, and construction of Industrial filters have proved out in long service and low maintenance costs. Industrial has the experience and is large enough to handle your filter requirements. Since 1927 filters and filtration systems have been an important part of our business.

INDUSTRIAL Water Demineralizers

for **No stains after hot rinse. No unwanted precipitates in solutions.**



A four-bed Industrial Water Demineralizer. Standard two- and four-bed units available with capacities of 200 to 1000 gph. Special units of any capacity engineered to requirements.

Write for full information and recommendations

FILTERS Pressure Type · PUMPS Centrifugal · CORROSION TESTING APPARATUS Salt Fog • Humidity

INDUSTRIAL FILTER & PUMP MFG. CO.

1635 West Carroll Ave.
Chicago 12, Illinois

RUBBER DIVISION Vulcanized Linings • Molded Products · WATER DEMINERALIZERS

Personals

C. Heamon Castle, Technical Director, was elected to the position of Vice-President at the annual meeting of the Board of Directors of the Roto-Finish Company, Kalamazoo, Mich.

Castle

Other officers of the Company are **D. T. Barrett,** President and Treasurer, and **J. W. Servaas,** Vice-President and Secretary.

L. A. Danse, Supervisor of Materials and Processes, Production Engineering Section, General Motors Corporation, Detroit, Mich., recently received presidential

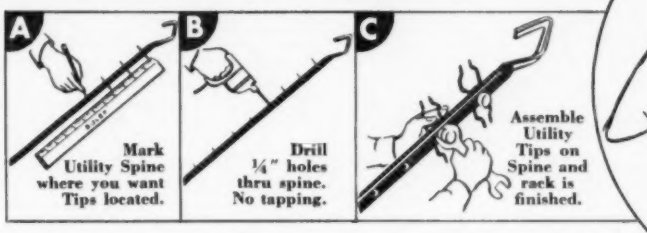
Danse

reappointment to the eleven-man Water Pollution Control Advisory Board. This Board was created in 1948 to review Public Health Service water-pollution-control activities and make recommendations to the Surgeon General.

Dr. James T. Eaton has been named Director of Research of E. F. Houghton & Company, chemical manufacturers of Philadelphia, Pa. Dr. Eaton, who was formerly Manager of Research, is in full charge of the Company's Research & Control Department. He was recently elected a member of the company's Board of Directors.

Marc Darrin, until recently Chief Chemist of Mutual Chemical Company of America in Baltimore, Md., was recently made Associate Director of Research of that company. He is the energetic chairman of Subcommittee V on Supplementary Treatment for Metallic Coatings of Committee B-8 of the American Society for Testing Materials.

Efficient Racks For Any Job In A Matter of Minutes


A
Mark Utility Spine where you want Tips located.
B
Drill ¼" holes thru spine. No tapping.
C
Assemble Utility Tips on Spine and rack is finished.

With a supply of *BELKE Utility Spines and Tips* on hand, it's that simple—that fast—that easy to have *complete racks* designed for your job, whether chrome or any other plating.

Universal Plastic Coating on Utility Spines and Tips withstands all cleaning and plating cycles. You space Utility Tips the way you want them. They join the spine with a leakproof seal, yet are easily changed or respaced on the spine. The five Utility Tip models have been developed in collaboration with experienced platers to efficiently handle 90% of all plating jobs. All models have spring pressure contacts for copper-nickel-chrome plating.

BELKE VAC-SEAL REMOVABLE TIP DESIGN

Flexible, Cup-like Collar of Universal Plastic is forced against spine coating, forming a leak-proof union. (pats. pend.)
Spines and Tips Coated with Universal Plastic. Withstands all plating cycles.
Drill ¼" hole thru coated spine. No tapping. Will not injure coating.
Tapered Nut tightens against spine metal to support tip, assuring positive contact. (pats. pend.)
Knurled Shank is drawn into spine metal. Tips cannot twist or turn. Positive contact is assured. (pats. pend.)
Threaded Lucite Cap encloses nut. (pats. pend.)

BELKE UTILITY SPINES

$2.85 ea.

30" and 36" lengths. Fabricated from ¼" x ⅝" round-edge copper stock with thick coating of BELKE Universal Plastic.

Style 1 (3 sizes)

Style 2 (3 sizes)

Style 3

Style 4

FIVE UTILITY TIP STYLES

Only 4 most popular shown. Other styles to specifications. All styles coated with Universal Plastic.

Plating Rack Economy Never Before Equalled

BELKE Utility Racks give tremendous service life. The Removable, Interchangeable Tips enable you to use them over and over again on countless jobs of every description. When holes in Utility Spines are not in use, BELKE Removable Plugs can be used to seal out solutions.

What's more, BELKE Utility Racks cost you half as much as specially designed racks.

Immediate Delivery. Write for complete prices and specifications—or consult your BELKE Service Engineer.

Belke MANUFACTURING CO.
947 North Cicero Ave.
Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS

Trade Literature

L—402. Metal Cleaning Guide—Oakite Products, Inc., 140 Thames Street, New York 6, N. Y., has published an illustrated 44-page booklet, which reviews metal cleaning in all its phases.

Having considered briefly the wide variety of soils—oil, grease, rust, heat-scale, smut, tarnish, forming compounds, buffing compounds, rust preventives, metal dust and shop dirt—which result from fabricating operations, the booklet discusses specific materials, equipment, and procedures for most effective removal of these soils by tank cleaning; machine cleaning; electrocleaning of steel, brass, and other nonferrous metals; pickling; deoxidizing; bright dipping; pre-paint cleaning and surface preparation by machine, tank and manual methods; steam-detergent cleaning; barrel cleaning; burnishing. The booklet also offers recommendations for improving the effectiveness of metal-cleaning operations in hard-water areas; for anti-rust protection of parts in production and during storage; on coolants and lubricants for machining and grinding; on simplified paint-stripping methods; and on treating wash water in paint-spray booths. For your copy, use Reader Service Card.

L—403. Small-Lot Plating Barrels—Bulletin 1120 furnished by the Belke Manufacturing Company, 947 N. Cicero Avenue, Chicago 51, Ill., gives complete information on Belke Porto-Platers and other Belke Small-Lot Barrels for plating small odd lots in still plating tanks. Information on Belke Oblique Platers is also included. For your copy, use Reader Service Card.

L—404. Nickel Anode Bags—William Parker, P. O. Box 209, Worchester 1, Mass., has issued (1) a 4-page folder listing specifications and prices of his nickel-anode bags and a sheet setting forth tests for the suitability of such bags. For your copies, use Reader Service Card.

L—405. Selenium Rectifiers—Fansteel Metallurgical Corporation, Rectifier Division, N. Chicago, Ill., offers a Bulletin RDP-112 with engineering information, diagrams and tables about its line of selenium rectifiers. Stable output characteristics over extended periods, high efficiency over wide range of output, and availability of three standardized protective coatings are claimed. For your copy, use Reader Service Card.

L—406. Ball Burnishing Materials—A catalog released by The Abbott Ball Company of Hartford, Conn., contains data about Abbott burnishing materials, including special shapes. Also included are sections on bearing balls. For your copy, use Reader Service Card.

L—407. Aluminum Cleaner—The Metal Industries Department of The Diversey Corporation, Chicago, now offers a twelve-page manual which is a technical presentation of The Diversey Pretreatment of Aluminum for Spot Welding. The process is described in detail, and the reasons for and advantages of its outstanding characteristics are discussed. Many pictures, charts, graphs, and case-histories support the claims for this process. For your copy, use Reader Service Card.

L—408. Wet Abrasive Finishing—A method of deburring and honing of all types of metals known as "HydroHone" is described in a two-color 4-page bulletin issued by Hydrohone Equipment Company, 222 W. Chambers Street, Milwaukee 12, Wis. For your copy, use Reader Service Card.

L—409. Combined Colorimeter-Nephelometer—Coleman Instruments, Inc., 318 Madison Street, Maywood 1, Ill., offers a Bulletin B-215 which describes its Model 9 Napho-Colorimeter. When used as a nephelometer, the instrument projects through the sample an intense filtered beam of optically controlled light. The usual reflection errors are largely eliminated by the special optical system and residual reflection by the photoelectric circuit. For your copy, use Reader Service Card.

L—410. Chemically Resistant Coatings—Maurice A. Knight Company, Kelly Avenue, Akron 6, Ohio, offers an

Highest stabilized degreasing solvent

—Stabilized NOT Alkalized

Years of research and development have produced this outstanding new BLACOSOLV. This new product has been subjected to the most rigorous stability tests for the most difficult jobs. Contains no alkaline materials which neutralize acid *after* breakdown. The new stabilizers *prevent* solvent breakdown and possible acid formation.

The new BLACOSOLV will degrease scientifically all metals or combinations of metals. You need not pay premium prices for special solvents for different metals. Blacosolv can be used over and over without impairing its high qualities.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

Federated ANODES

for the Plating Trade

COPPER Anodes . . . M-Sterling Chill-formed in flat, oval, wedge, and ball shapes. Open mold shapes also available. All of prime electrolytic copper.

COPPER Anodes . . . electro-deposited, in all standard sizes . . . special sizes to order.

LEAD Anodes . . . the M-Sterling Dated Conducta-Core Anode with specially designed strong hooks coated to protect against acid fumes and spray.

TIN Anodes . . . flat and oval shapes . . . all standard sizes . . . made only of extra high purity tin.

ZINC Anodes . . . only of Special High Grade zinc in all standard sizes and shapes.

BRASS Anodes . . . full range of analyses . . . flat, oval, wedge, and ball shapes.

Federated Anodes are sold through offices in 22 principal cities. Quality is continuously controlled by Federated metallurgists so that the anodes are free of gates, flash, and cavities . . . of high chemical purity . . . to give uniform plating performance.

Write, wire, or phone for complete information

Federated Metals Division

American Smelting and Refining Company, 120 Broadway, New York 5, New York

CHROMIC ACID

99.75% PURE

POTASSIUM BICHROMATE
•
SODIUM BICHROMATE

SINCE 1845 MUTUAL CHEMICAL COMPANY OF AMERICA

270 Madison Avenue, New York 16, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 344.

Take this way to better savings

WHEN buying tanks for plating service, divide what-will-it-cost by how-long-will-it-last—and get the cost per year of your tanks. You'll find that cutting out maintenance and replacement costs means a better saving than low first cost and short life. Then get our quotations on tanks Stortswelded for more years of trouble-free service.

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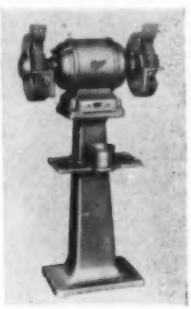
Trade Literature

8-page Bulletin 3J, which lists the characteristics of Pyroflex Lacquer, its industrial application, and methods of application. For your copy, use Reader Service Card.

L—411. Water Stills—Precision Scientific Company, 3737 W. Cortland Street, Chicago 47, Ill., has published a 6-page Bulletin No. 910 which illustrates and describes in detail its line of steam-, gas-, or electrically heated water stills for industrial and laboratory use. For your copy, use Reader Service Card.

L—412. Dust Control—A 12-page catalog, DC49-120, "Duclone Collectors" for Industrial Dust Control and Recovery has been issued by The Ducon Company, Mineola, N. Y. It describes constructional and operating features and is illustrated with efficiency curves, schematic drawings of different industrial applications, and many other pertinent illustrations. For your copy, use Reader Service Card.



L—413. Grinders and Buffers—The Hisey-Wolf Machine Company, Cincinnati 8, Ohio, offers a Bulletin 7-14 covering its Economy line of grinders and buffers which are considerably lower in cost than its standard heavy duty machines. The entire line has just been redesigned, incorporating streamlined appearance with pedestals which are larger at the floor for the reduction of vibration. For your copy, use Reader Service Card.

L—414. Valve-Sizing Charts—Liquid and gas valve-sizing charts, covering the ranges 0.02–10,000 gallons per minute and 1–100,000 pounds per hour respectively, have just been published by Fischer and Porter Company, Department 7007, Hatboro, Pa.

The liquid valve-sizing chart takes into account the difference between pressure drop across the valve and across the valve ports alone, liquid viscosity, and specific gravity in determining port area and valve size. The gas valve-sizing chart takes into account inlet and outlet absolute pressures, gas specific gravity and

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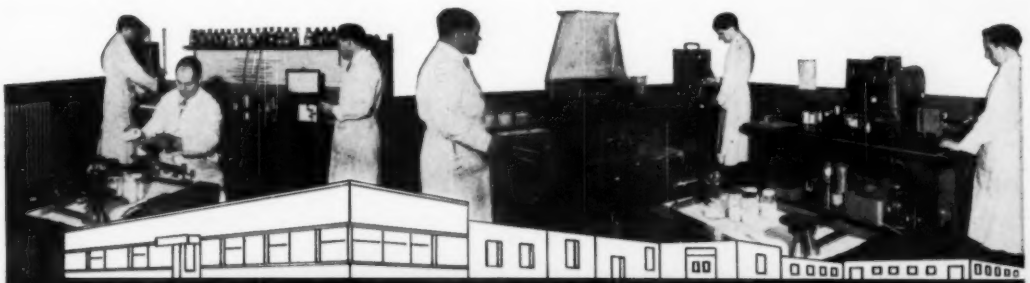

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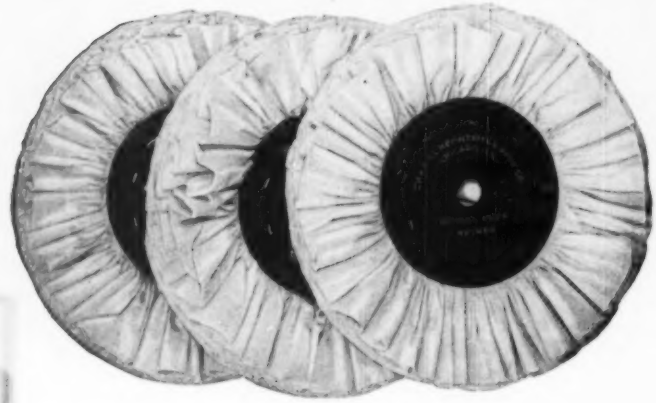

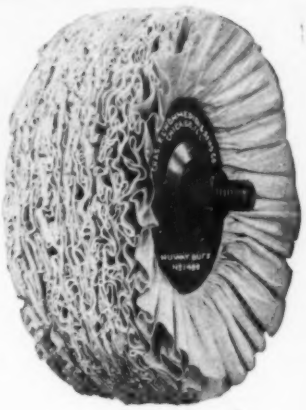

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TUB CAN BE LIFTED OUT FOR DUMPING AND TUMBLING BARREL INSERTED FOR TUMBLING INSTEAD OF PLATING—VERY RIGID—THREE SPEEDS.

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Platers who use Improved MICCROSOL E-1003 call its miraculous performance and long life on the job "Modern Magic" . . . magic that steps up production while saving both time and money.

Developed to meet today's severe demands, this vastly improved, rugged rack coating is "modern" in every way. It gives you the utmost in performance, durability, and economy.

If for some reason our salesman in your territory is not contacting you regularly, and you would like some additional information on Improved MICCROSOL E-1003, we will be glad to send you a detailed bulletin. WRITE US TODAY!

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FUTURA, INC.
2323 W. Maryland . . . Evansville, Indiana
GLOVER COATING COMPANY
376 Washington Street . . . Malden 48, Mass.
IMPERIAL PLATING RACK CO.
800 Industrial Street . . . Flint, Michigan
INDUSTRIAL RACKS, INC.
Waterbury, Conn.
MICHIGAN CHROME & CHEMICAL CO.
6340 E. Jefferson Ave. . . . Detroit 7, Michigan
MIDWEST PLATING & CHEMICAL CO.
1509 N. Washington . . . Kokomo, Indiana
NATIONAL RACK COMPANY
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PERMA-LINE RUBBER PRODUCTS CO.
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RACK INSULATION SERVICE
740 N. Wooster St. . . . Strasburg, Ohio
J. F. REED MANUFACTURING CORP.
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FREDERIC B. STEVENS OF CANADA, LTD.
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Trade Literature

temperature. For your copy, use Reader Service Card.

L—415. New Plate-Type Rheostat—A new plate-type rheostat has been announced by General Electric's Control Divisions and is described in a 2-page Catalogue Section GEC-487.

The new rheostat is furnished in three forms: the 6-inch form with 27 resistance divisions, the 9-inch form with 52 resistance divisions, and the 12-inch form with 70 resistance divisions. All are available immediately, including sequence and concentric rheostats as well as sprocket and motor mechanisms.

The rheostat is specifically designed for field control of d-c shunt-or compound-wound motors, self-excited generators, exciters, separately excited generators, and synchronous motors. For your copy, use Reader Service Card.

L—416. Pre-Paint Cleaner—How Oakite Compound No. 33 (1) removes oil, (2) removes rust, and (3) prepares metal for paint in a single procedure is described in a special Service Report issued by Oakite Products, Inc., 140 Thames Street, New York 6, N. Y.

The compound is said to have solvent and detergent properties effective in removing stamping and forming oils, rust preventives, carbon smuts, soldering and welding fluxes, identification inks, and similar soils; to contain acid ingredients that act on rust, heat scale, tarnish and other oxides, as well as special accelerating agents that make rust removal (along with removal of oil) a fast operation; and to convert the surface layer of metal into a thin film of insoluble phosphates, which provides an excellent bond for paint. Material is said to have similar etching and conditioning action on aluminum sheets and aluminum castings. Where the type of work precludes the use of automatic spray-type washing equipment, the material may be applied by soak-tank or hand-swabbing methods. For your copy, use Reader Service Card.

L—417. Gaging of Dry Films and Foils—Henry A. Gardner Laboratory, Inc., 4723 Elm Street, Bethesda 14, Md. announces a highly accurate method for measuring the thickness of attached dry films and of thin sheet metals, foils, paper, or plastic by means of the Interchemical Direct Reading Thickness Gage (widely known and used in the finishes field for wet-film measurement), an optical attachment, plus a suitable light source. Measurements are said to be readily reproducible with sharp endpoints, and results may come closer to calculated theoretical thickness values than those obtained by any other type of instrument because no pressure is exerted against yielding surfaces. For free literature, use Reader Service Card.

L—418. Glass Pipe and Fittings—Glass pipe and fittings in ¼- through ¾-inch sizes are illustrated and described in a new catalog 94 just published by Fischer & Porter Company, Hatboro, Pa. Also included is complete information on a recently introduced metal-to-glass and glass-to-glass pipe coupling available in ¼- through 1-inch sizes, which replaces three-bolt triangular metal flanges and other devices. Easy to assemble, it greatly simplifies the installation and maintenance of glass piping. Perfect alignment is assured and even takeup gives freedom from breakage. Installation time is reduced, sometimes as much as 60 per cent in comparison with other methods. For your copy, use Reader Service Card.

L—419. Water Hardness Titration—W. H. and L. D. Betz, Philadelphia 24, Pa., offer complete chemical data on their test set and chemicals for determination of total water hardness by simple colorimetric titration. For your copy, use Reader Service Card.

L—420. Water Demineralizers—Barnstead Still & Sterilizer Company, Inc., 228 Lanesville Terrace, Forest Hills, Boston 31, Mass., has issued a 20-page Catalog 123 which describes in detail the difference between distilled and demineralized water; highlights the advantages of use of either in manufacturing and processing operations which call for pure water; cites case histories on quality control of water that has resulted in better products, uniform results, fewer rejects,

NO SHUT DOWN
to carbon treat solution with . . .
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SPARKLER *plate* **FILTERS**

SPARKLER horizontal plate FILTERS

Only a few minutes are required to lift out the horizontal plate assembly in a Sparkler Filter and drop in a clean set of filter plates and production is under way without appreciable interruption.

Tanks are given a carbon treatment without shutting down production in the battery installation shown here. One or two filters are cut out of the line, drained, cleaned and dressed with clean filter papers. The proper amount of carbon is mixed with water in a stand-by tank and recirculated through the filters thus depositing the carbon on the plates in a cake of uniform thickness and density. The solution requiring a carbon treatment is then circulated through the carbon beds giving the plating solution the carbon treatment without contaminating the tank or stopping plating operations.

Sparkler Horizontal Plate filters give absolutely sharp filtration at all stages of the cycle.

A battery of 18 Sparkler Filters in one of the largest bright nickel plating plants in the world.

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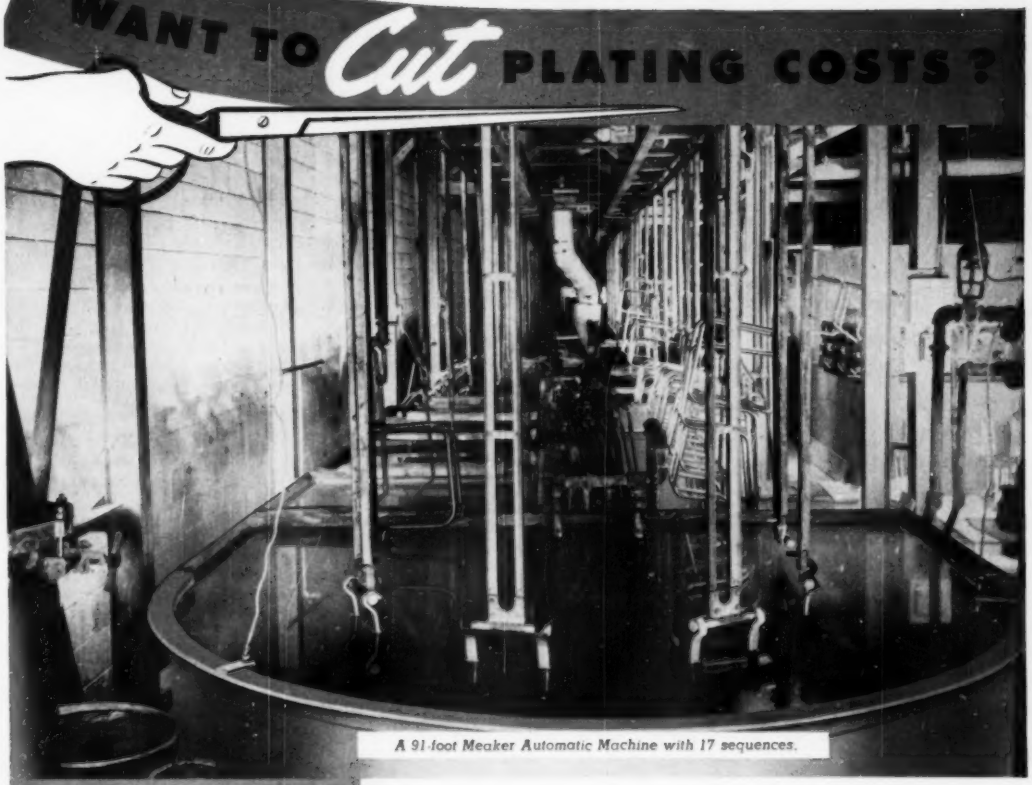

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You save three ways with a Meaker plating machine. In many cases the savings in labor costs, space, and chemicals alone have paid for the Meaker equipment in a very short time. Increased production is a natural result. A better and more uniform plating job is assured. Furthermore, cleaner and more agreeable working conditions reduce personnel turnover to a minimum.

A Meaker machine makes every operation in the plating sequence automatic, or as mechanized as possible. It is the profitable way to do electroplating on a competitive basis. Large percentage savings have been the rule both in the plating departments with medium output and in the mass production plants.

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24″ Anodes	$1.00 each
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24″ Anodes	60c each
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Robins' all nylon anode bags made of TOUGH du Pont chemically resistant nylon offer important advantages:

☆ TEAR RESISTANT
3 to 4 times tensile strength and elasticity of cotton

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Trade Literature

and the reduction of costs in plant operations; and shows how ion-exchange purification works. For your copy, use Reader Service Card.

L—421. "Techniques of Plant Maintenance—1950"—The 278-page 8½ x 11 text of the comprehensive discussion of plant-maintenance problems at the recent Plant Maintenance Conference in Cleveland, Ohio, is available from Clapp & Poliak, Inc., 341 Madison Avenue, New York 17, N. Y., at two dollars postpaid.

Subjects covered include maintenance organization and principles; maintenance costs and budgeting; selection and upkeep of lighting equipment; upkeep of motors, controls and distribution equipment; use of electrical instruments in maintenance; upkeep of floors, walls and roofs; relationship of lighting and color to production; sanitation and housekeeping; lubrication; application of service equipment; protection of plant and worker, and the importance of maintenance to safety.

L—422. Manual of Electric Instruments—A revised 150-page edition of General Electric's "Manual of Electric Instruments" has been announced by the Company's Meter and Instrument Divisions. Its thirteen chapters explain the fundamentals of such instruments as thermocouples, synchroscopes, frequency meters, and electric telemeters and are extensively illustrated by photographs and diagrams. An added feature of this library-type textbook is a full reference index.

Priced at $1.00 per copy, the "Manual of Electric Instruments" (GET-1087A) may be obtained from the General Electric Company, Schenectady 5, N. Y.

L—423. Humidity Cabinets—Bowser, Inc., Refrigeration Division, Terryville, Conn., offers a bulletin describing its Relative Humidity Units in which humidity is maintained automatically at 20-95 per cent between 35 and 175° F. They are available in 10-, 20- and 30-cu ft capacity with stainless-steel interiors and exteriors. For your copy, use Reader Service Card.

L—424. Planned Lighting—A 32-page "Planning Guide to Improved Plant Lighting" describing the benefits to be gained and the methods to employ to put a planned lighting program into effect, has just been published by Benjamin Electric Manufacturing Company, Des Plaines, Ill. The Guide covers the subject from the management viewpoint, dividing it into three major parts: Economics; Program Development; and Equipment Selection. For your copy, use Reader Service Card.

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ALUMINUM FINISHING AND CLEANING

CHEMLUSTRE (No. 914): Gives badly weathered aluminum a uniform and bright appearance; lustrous semi-satin finish. Substitutes an inexpensive dip for expensive polishing or wheel operations before anodizing.

CHEMCLEAN No. 905: Aluminum conditioner—forms a base for synthetic coatings; non-conductive and passive.

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AND—special compounds for special aluminum cleaning and treatment problems.

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BURNISH-ALL which burnishes all metals—ferrous—non-ferrous—precious.

DI-PHASE CLEANER (Chemclean No. 133) which removes buffing compounds, hard, caked-on soils, oils, greases and drawing compounds.

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ARE YOU GETTING *THESE RESULTS* FROM YOUR PRESENT BATHS?

FOR CADMIUM

ROHCO 100 BARREL ZINC BRIGHTENER:

ROHCO 100 is a concentrated liquid brightener easily diluted with water for daily or single load additions. Produces brilliant deposits directly from the bath at a lower cost. Has the ability to plate many types of ferrous metals which usually do not readily plate with zinc.

An improved zinc bath formulation minimizes brightener consumption, promotes rapid deposition without re-solution of the plated zinc, reduces chemical attack of zinc anodes and makes proper solution maintenance easier. Your present bath can readily be changed to the improved formulation.

Although ROHCO 100 Barrel Zinc Brightener can be used in your present bath, its combination with the improved zinc bath formulation is unequalled for highest production at lowest cost.

LOWEST COST

HIGHEST PRODUCTION

SIMPLEST CONTROL

ROHCO 20XL CADMIUM BARREL AND STILL BRIGHTENER:

ROHCO 20XL is a concentrated liquid which gives highest throwing and covering power at a cost of less than 2% of the cost of the cadmium metal plated. Produces brilliant deposits directly from the plating bath at the lowest cost per load.

ROHCO 20XL gives unbelievable uniformity of deposit thickness and hence reduces the amount of cadmium consumed in meeting minimum thickness specifications. An improved cadmium bath formulation provides unusually high conductivity and, with ROHCO 20XL, permits temperatures up to 105° F. in barrel plating.

ROHCO 20XL is very easy to control because it has an unusually wide latitude of operable concentration range.

Conversion to ROHCO 100 or ROHCO 20XL does not entail extra treatment or delay in production.

SEND SAMPLE OF YOUR PRESENT BATH FOR FREE ANALYSIS AND RECOMMENDATIONS!

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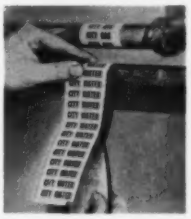
Trade Literature

L—425. Electronic Potentiometer—A 4-page illustrated bulletin issued by Southwestern Industrial Electronic Company, 2831 Post Oak Road, Houston 19, Texas, describes the New Model P-2 Precision Electronic Potentiometer, available for precise potential measurements on high impedance electrochemical cells or electronic tubes and circuits. The instrument is suitable for the measurement of potentials from zero to three volts in three ranges. Current flow in the measured circuit is less than 10^{-11} amperes, making the instrument fully suitable for use with glass electrodes. A built-in standard cell, combined with a 0.1 per cent potentiometer and dual range dial, provides an accuracy of ±1 millivolt. The instrument is well suited for precise *p*H measurements, having a comparative accuracy of 0.05 *p*H units. For your copy, use Reader Service Card.

L—426. New Resin Guide for Surface Coatings—Designed to aid the formulator in selecting the proper resin for his needs, a compact guide, issued by American Cyanamid Company, Coating Resins Department, 30 Rockefeller Plaza, New York 20, N. Y., is devoted exclusively to tabulating the physical and chemical properties of each of the surface-coating resins manufactured by the company. These resins include Rezyl Alkyd Resins, Melmac Melamine Resins, Beetle Urea Resins, Cycopol Copolymer Resins, Phenac Phenol Resins, and Teglac Diabasic-Acid Modified Resins. For your copy, use Reader Service Card.

L—427. Identifying Pipe and Conduit—Bulletin No. 144 issued by W. H. Brady Company, Dept. 132, 815 N. 3rd Street, Milwaukee 3, Wisc., describes and illustrates the new self-adhesive Quik-Label Pipe Marker for identifying small



diameter pipe and conduit from ¼- to 2-inch diameter. Description includes other sizes of markers for large pipe and conduit. All markers are said to conform to ASA Standard No. A13, "Identification of Piping Systems". For your copy, use Reader Service Card.

L—428. Impulse Timer—Zenith Electric Company, 152 W. Walton Street, Chicago 10, Ill., offers the Model RT Impulse Timer without gears and clutch. It is described in new 4-page illustrated Bulletin No. 142 and provides impulse circuit for production-line control, pilot circuit, other timing, on-and-off circuit for exhaust fans, laboratory testing, etc. For your copy, use Reader Service Card.

L—429. Aluminum Polishing with Abrasive Belts—The latest issue of Reynolds Metals Company's technical periodical, "Technical Advisor", carries a feature article on polishing aluminum with abrasive belts. It details a number of standard and special machine setups for handling a wide variety of work and contains data on belt recommendations and operating practices.

The "Technical Advisor" is supplied without charge upon request to Editorial Department, Reynolds Metals Company, 2500 S. Third Street, Louisville, Ky.

L—430. Temperature Indicators—A new line of temperature indicators for industrial and laboratory use, announced by General Electric Company, Schenectady 5, N. Y., is described in its Bulletin GEC-565.

Included in the line are cold-end compensated thermocouple thermometers for measuring temperatures up to 3000° F and resistance thermometers for temperatures up to 300° F.

Designed for the measurement of low temperatures where high accuracy is important, the latter are available in two standard types: the DB-15 long-scale instruments and the Types DD-6 and DD-7 six-inch rectangular, surface- and flush-mounted instruments. For your copy, use Reader Service Card.

Start Clean... Stay Clean!

Clean shoes for the party . . . a clean bath for the Plating!

Don't smear the works at any time—especially when it comes to putting clean work into a plating bath of questionable purity and running the risk of wasting the time, labor, and expense that goes into cleaning work for plating.

Start clean . . . *stay* clean—use Darco S-51 to *keep* impurities out of your plating bath. Darco adsorbs impurities to its surfaces before they can be deposited on the freshly cleaned surface of your work.

Is your plating bath as clean as the water in your final rinse?

Darco Red Label S-51 is especially easy to handle . . . to wet . . . to incorporate into a slurry. It's especially treated for use in plating—*the only carbon that will meet the benzol-mercury test!* Place an order for Red Label Darco S-51 today. Practically all leading suppliers carry Darco—do not accept substitutes!

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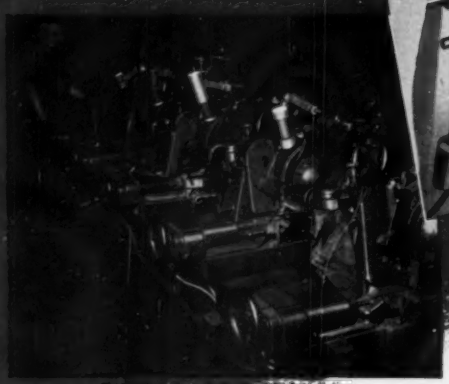

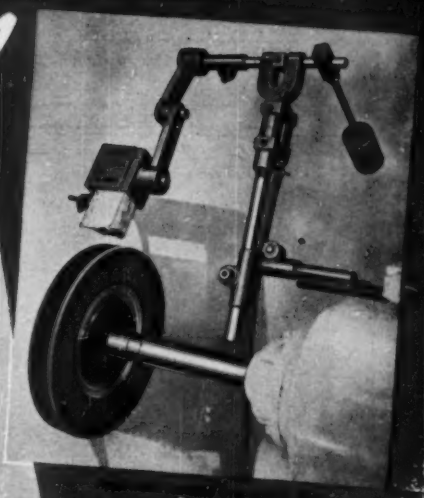

Appli-matics Apply Buffing Compounds AUTOMATICALLY with the EXPERT'S TOUCH

SAVE BUFFS—The NEW Vander Wal-Wagner Appli-matics reduce wear on buffs caused by too little or too much compound. Foot-treadle or knee-lever control of air-trip enables operator to determine intervals and amount of compound as work progresses. Ideal for polishing lathe or automatic.

SAVE LABOR—Buffing compound is applied without interruption of work. Loading of receptacles takes only two seconds—without stopping machine. Full time wheel tender not required, yet Appli-matics permit application to each wheel independently of others in a multiple set-up.

SAVE COMPOUND—Appli-matics' receptacles grip your bar right down to the "nubbin" with safety, eliminate waste from overloading, too. A touch of the operator's toe or knee actuates application, by gravity alone, of the correct amount of compound he needs to build a good "face" on the buff.

SIMPLIFY INSTALLATION—Any mechanic can install Appli-matics with simple tools. Brackets are universally adjustable to apply to any spot on the wheel. Low-pressure air line permits use of plain hose for flexibility. There are no electrical connections or fine adjustments.

SIMPLIFY MAINTENANCE—The only actuating power is gravity, hence there are no complicated motors, gears, switches or other mechanisms demanding frequent attention. The small air-cylinder which trips the counter-balance requires no lubrication. Appli-matics are bronze bushed throughout for long life.

PRODUCE SUPERIOR WORK—You get all the desirable results of costly hand application. Your operator uses his training, skill and judgment to build a good "face," applies compounds at any time or at any work position in cam-operated automatics, thus avoids loading of the work. Your "too much or too little" problem is solved. For complete information, see your Wagner representative or send for new bulletin.

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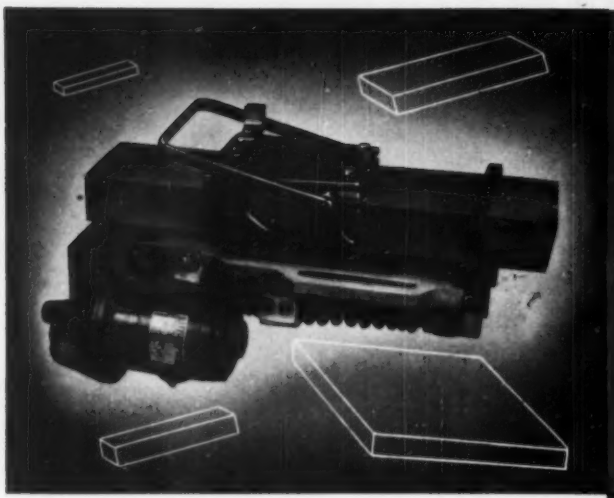

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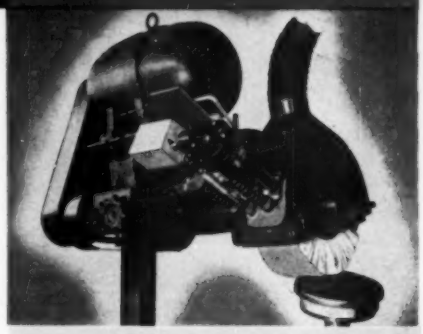

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Published by the American Electroplaters' Society at 5800 N. Marvine Street, Philadelphia, Pa. Editorial, Advertising and Executive Offices: 473 York Road, Jenkintown, Pa. Phone: Ogontz 9650-1. Subscriptions: Domestic and Canada, $4.00 per year, 50c per copy; Foreign, $6.00 per year, 75c per copy.

PLATING is abstracted regularly in Chemical Abstracts, Engineering Index, Technical Data Digest and Bulletin Analytique.

plating

MAY 1950 VOL. 37 NO. 5

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Editorial

Something Old, Something New

WHEN A NEW DEVELOPMENT appears, its proponents often predict that it will replace existing methods or equipment. Only look at the automobile and the truck, they say, and see how it has replaced the horse.

Newton's third law of motion tells us, however, that for every action there is an equal and opposite reaction. In the present connection it would mean that the advent of a new development forces those with a stake in the old to meet the competition of the new. This may be done in several ways.

First, their effort may be directed toward combining the new and the old. Decorative chromium plating, for example, instead of being hurt by the invention of colorful plastics and plastic coatings, has found many new applications enhancing the beauty of the plastic.

Second, they may promote expansion in the particular fields in which the old is still superior. An excellent example of this is the growth of cadmium plating which took place following the arrival of bright-zinc plating.

Third, and perhaps most important, they may set their technicians to work improving the old to make it better able to compete with the new. The technical program to be presented at the Boston Convention of the American Electroplaters' Society offers a case in point: the sessions on levelling by nonmechanical means are followed by a session on new developments in mechanical finishing that have come about, directly or indirectly, as a result of the new competition.

The promoter is often baffled by the seeming unwillingness on the part of a prospect to strike out and put to use a new invention. What he does not realize is that the user of an old process, etc., consciously or subconsciously, is awaiting the reaction. He suspects that the final outcome will not be a simple choice of "either . . . or . . ." but a "both . . . and . . ."

The producer of the old, on the contrary, is confronted by a clearcut choice. Either he does something constructive about the new situation, or his business suffers. The reaction of which Newton speaks does not always result in a positive achievement where human beings are concerned. Hesitancy and fear may take its place. The modern philosopher Toynbee's thesis, that civilizations disappear for lack of effective response to challenges, applies with equal force in the economic field.

Technologic progress, therefore, usually results not from the initiating action alone; it also requires swift and efficient reaction. The case of the automobile and truck is an exception to the rule; the horse was not sufficiently adaptable to offer much competition.

Gustaf Soderberg

Determination of Free Cyanide and Ammonia in Brass and Bronze* Plating Baths

Part I. Theory and Literature Review of Free Cyanide Determination

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Importance of Free Cyanide

The concentration of free sodium cyanide in brass plating solutions is a most important variable because it has a profound effect on both the properties of the deposit and the operation of the bath. The specific effects are listed in Table I.

Definition of Free Cyanide

The term "free cyanide" has been defined in two ways:

(1) The excess of sodium cyanide above the minimum required to give a clear solution, i. e., the difference between the total sodium cyanide content† and the amount of sodium cyanide required to keep all the metallic compounds in solution in the presence of other constituents of the bath[1].

(2) The sodium cyanide in excess of that required to form the complex double cyanides of copper and zinc corresponding to $Na_3Cu(CN)_3$ and $Na_2Zn(CN)_4$[2].

The first definition[1] seeks to specify that property which directly affects the behavior and utility of the bath rather than to offer an exact knowledge of the complex cyanides which exist in the solution along with the free cyanide. The most important property specified by this definition is the solvent action of the free cyanide on the anode film. Thus a solution having no free cyanide, according to this definition, will have no solvent action on the anode film, and the free cyanide concentration will therefore be a direct measure of the solvent power of the solution. The proposed definition excludes the possibility of a negative value of free cyanide. It recognizes the fallacy of certain analytical methods which use arbitrary conditions and assumptions and arrive at rigid conclusions regarding the constituents in the bath. However, to date no analytical method has been published for determining the free cyanide as first defined, and it is doubtful whether this definition could be applied to the mixture of complex copper and zinc cyanides which are present in a brass plating solution.

The free cyanide in a brass plating solution is usually determined according to the second definition[2], by direct titration against standard silver nitrate solution in the presence of potassium iodide indicator. There are many variations of this method in the literature and in general use, but none which is universally accepted and applied. In one indirect method[3], the free cyanide is determined by calculation from values of total cyanide, copper and zinc on the assumption that the copper exists solely as $Na_3Cu(CN)_3$ and the zinc solely as $Na_2Zn(CN)_4$.

With a given brass solution, widely different values

*High copper-zinc alloy.

†The total cyanide content is the content of the cyanide radical (CN) in all active forms. It has also been designated as the "total effective cyanide" because it does not include the CN which is present as inert ferrocyanide which accumulates as an impurity in old cyanide baths[2].

of free cyanide are obtained by the various methods. These in turn are carried out with varying degrees of effort and reproducibility as will be shown in Part II of this article. This situation leads to confusion. A value of free cyanide cited in the literature is not significant unless the method of analysis is given. It is believed that some of the difficulties encountered in the operation of brass solutions may be caused by poor control of the free cyanide resulting from the use of an unreliable analytical method. The need of reviewing the methods of analysis is, therefore, strongly indicated.

The primary purpose of this article was to study critically and evaluate experimentally the methods in the literature and in general use for determining the free cyanide in brass plating solutions with the object of deciding upon a preferred and possibly improved method. It was recognized, however, that the present confused situation may be caused by fundamental difficulties which may be hard or impossible to resolve completely.

Fundamental Difficulties

There are certain fundamental difficulties involved in the determination of free cyanide in a brass plating solution; indeed, in any cyanide type of plating solution. In a given brass bath under a given set of conditions, there obviously exists a definite amount of free cyanide. To date, however, there is no method available for determining this amount of free cyanide, although in many cases its determination is implied. The reason will become evident from the following considerations:

In a brass solution there is an equilibrium among the copper cyanide complexes, the zinc complexes, and the free sodium cyanide. This equilibrium, and consequently the absolute value of the free sodium cyanide content, is shifted by many factors both internal and external to the solution such as the metal and sodium carbonate concentrations, *p*H, etc.[1,2].

All of the analytical methods for determining the free cyanide shift the equilibrium and therefore the value of the free cyanide by virtue of the necessary dilution of the sample, addition of indicator, changes in temperature, etc. Consequently, these methods give the free cyanide existing in the diluted sample at the end point of the titration and *not* the free cyanide in the original brass solution. This explains why different values of free cyanide in a given brass bath are obtained by the different methods: the extent of dilution, the concentration of potassium iodide indicator, the temperature, etc., are all different at the end of the different analyses.

The amount of free cyanide found by the silver nitrate titration methods is valuable for control purposes and is, of course, widely used. A method for the determination of the *absolute* value of free cyanide in a plating solution would be a still more valuable tool and shed more light on (1) the various effects of free cyanide and (2) the nature of the metal complexes present in the solution. Wick[3] has done some preliminary experimental work in this field, which remains a very interesting subject for fundamental research.

TABLE I. EFFECT OF VARIATIONS IN THE FREE SODIUM CYANIDE CONTENT OF BRASS PLATING SOLUTIONS ON THE PROPERTIES OF THE DEPOSIT AND THE OPERATION OF THE BATH

Properties of the Deposit	Effect of Increasing the Free Cyanide	Reference
Color	Redder	29
Copper Content	Increases	43
Ductility	Affected	29
Adhesion	Poor at high concentrations	31, 37
Burning	Appears at high concentrations	41
Operation of Bath		
Cathode Efficiency	Decreases	27
Anode Efficiency	Increases	43
Anode Polarization	Decreases	27
Throwing Power	Increases	43
Conductivity	Increases	43
Tank Voltage	Decreases	43
Sludge Formation	Decreases	41

Chemistry of Copper and Zinc Complexes in Brass Plating Solutions

A typical brass plating solution is prepared by dissolving copper cyanide and zinc cyanide in a solution of sodium cyanide and finally adding sodium carbonate. The brass solution contains the following compounds:

alkali copper cyanide complexes
alkali zinc cyanide complexes
alkali zincate
free alkali cyanide
alkali carbonate

The chemistry of the copper and zinc complexes will now be reviewed.

Potassium Copper Cyanide Complexes

Three well defined alkali cuprocyanide complexes have been prepared in the solid state and completely identified[4]. Two of them, $KCu(CN)_2$ and $K_3Cu(CN)_4$, are readily soluble in water; the third, $KCu_2(CN)_3 \cdot H_2O$, is but sparingly soluble in water and, therefore, probably does not exist in a brass solution.

The existence of other alkali cuprocyanides is uncertain. The compound $K_2Cu(CN)_3$, for example, has never been isolated in the solid state, although many attempts have been made to do so. Bassett and Corbet[6] failed to detect it in a phase-rule study of the

system. However, Kunschert[7], by the concentration-cell method, and Glasstone[8], by electrometric titrations and solubility measurements, found evidence of the existence of the compound $K_2Cu(CN)_3$ in potassium cyanide solutions.

Sodium Zinc Cyanide Complexes

The only stable, well defined alkali zinc cyanide complex which has been prepared in the solid state is $Na_2Zn(CN)_4 \cdot 3H_2O$. It is obtained as large efflorescent orthorhombic crystals which are very soluble in water[5].

Evidence regarding the zinc cyanide complex $NaZn(CN)_3$ is conflicting. Sharwood[9] confirmed the existence of this salt which, however, was decomposed by water with the precipitation of basic cyanide. Herz[10] was unable to prepare the mono-sodium salt. Corbet[11] added an excess of zinc cyanide to a 10 per cent sodium cyanide solution, kept the mixture for an hour just below its boiling point, filtered and concentrated it. The crystals which separated appeared to contain both the mono- and di-sodium salt in the ratio of 3:7. They gave a turbid solution on the addition of water. All attempts to prepare a pure mono-sodium salt failed. Masaki[12], by titration methods, and Kunschert[13], by the concentration-cell method, have detected both the mono- and di-sodium salt in solution. However, Britton and Dodd[14], by potential and conductometric measurements, and Glasstone[15], by electrometric titration, found only $Na_2Zn(CN)_4$ and no evidence of $NaZn(CN)_3$.

Review of Literature on the Analysis of Free Cyanide in Plating Solutions

General Theory

Sodium cyanide in aqueous solution may be determined quantitatively by the Liebig method[16]. This method is based on the fact that silver nitrate forms a soluble double cyanide with an alkali cyanide:

$$2NaCN + AgNO_3 \rightarrow NaAg(CN)_2 + NaNO_3 \qquad (1)$$

When all of the sodium cyanide has been converted into the soluble double salt, $NaAg(CN)_2$, the next drop of silver nitrate solution reacts with the $NaAg(CN)_2$ and produces a permanent opalescent turbidity due to the precipitation of silver cyanide. This opalescence serves as the end point for the reaction.

$$NaAg(CN)_2 + AgNO_3 \rightarrow 2AgCN + NaNO_3 \qquad (2)$$

The method has been improved by the addition of potassium iodide[17] which renders the end point sharper and much more distinct and also prevents high readings which would otherwise occur in the presence of certain salts, such as excess alkali, ferrocyanides, etc.

$$KI + AgNO_3 \rightarrow AgI + KNO_3 \qquad (3)$$

Reaction (3) takes precedent over reaction (2) because AgI is more insoluble than AgCN.

While the Liebig method works well with sodium cyanide alone, cyanide plating baths contain in addition to free sodium cyanide the metal cyanide complexes and sodium carbonate. They may also contain sodium cyanate and ammonia from decomposition of sodium cyanide, and ferrocyanide resulting from attack on steel tanks, coils, ball-anode containers, and other parts. In spite of this, the Liebig method is generally used in the analysis of free cyanide in all cyanide plating solutions because of its reproducibility, simplicity, and rapidity.

Silver Plating Solutions

Liebig's method has been successfully applied to the analysis of free cyanide in silver plating solutions[18,19]. The free cyanide in excess of the complex $KAg(CN)_2$ is titrated. The addition of the potassium iodide indicator was found to prevent errors due to the presence in the plating bath of sodium hydroxide, sodium carbonate, ammonia, and ferrocyanide.

Copper Plating Solutions

In applying Liebig's method to copper plating solutions, Thompson[20] found that the value of free cyanide titrated depended upon the amount of potassium iodide indicator added. His data are reproduced here in Fig. 1. It will be seen that if the KI is absent or low, a high value of free cyanide is obtained which corresponds approximately to the cyanide in excess of a mixture of the complexes $NaCu(CN)_2$ and $Na_2Cu(CN)_3$. This was explained by considering that the higher coordination complex $Na_2Cu(CN)_3$ had changed to the lower coordination complex $NaCu(CN)_2$ with liberation of sodium cyanide which was titrated with standard silver nitrate. In other words, at the end

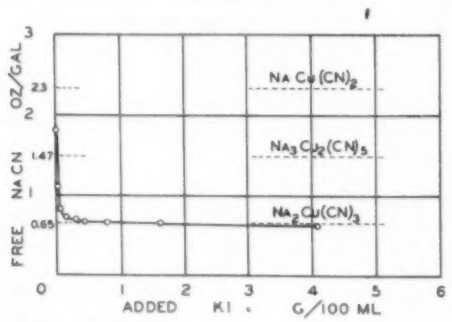

Fig. 1. Effect of added potassium iodide on free cyanide value in titration of copper cyanide bath prepared from 3.0 oz/gal (22.5 g/l) copper cyanide, 3.9 oz/gal (29.4 g/l) sodium cyanide and 2.1 oz/gl (15.9 g/l) anhydrous sodium carbonate. After Thompson

point given by equation (2) above, the following equilibrium had partially shifted to the right.

$$Na_2Cu(CN)_3 \rightleftarrows NaCu(CN)_2 + NaCN \quad (4)$$

With sufficient potassium iodide indicator present, the value of free cyanide titrated corresponds exactly to that in excess of the complex $Na_2Cu(CN)_3$. The reason is the greater tendency for the AgI to precipitate per equation (3) than for the equilibrium in equation (4) to shift.

Thompson's procedure is now standard for the determination of free cyanide in copper plating solutions. It gives reproducible results which are valuable for control purposes. Large amounts of sodium carbonate and ferrocyanide have negligible effects on the accuracy of the method.

The method appears to be the main source of the popular concept that the complex in the copper bath is $Na_2Cu(CN)_3$. It will be seen, however, from Thompson's original article and from the chemistry of the copper cyanide complexes given above, that this supposition is based entirely on coincidence; the complex corresponding to the formula $Na_2Cu(CN)_3$ is present in the bath only at the end of the Thompson titration.

There is no exact information on the copper complexes actually present in the copper bath. The solution probably contains a mixture of $Na_3Cu(CN)_4$ and $NaCu(CN)_2$ which are the only soluble complexes which have been isolated and identified. It is interesting to note that an equimolecular mixture of these two complexes would be equivalent to the formula $Na_2Cu(CN)_3$.

It is probable that a copper solution at room temperature is predominantly $Na_3Cu(CN)_4$ in equilibrium with lower coordination complexes.

$$Na_3Cu(CN)_4 \rightleftarrows [Na_2Cu(CN)_3 + NaCN] \rightleftarrows NaCu(CN)_2 + 2NaCN \quad (5)$$

The removal of sodium cyanide during the course of the silver nitrate titration favors the shift of the equilibrium to the right.

Heating of the copper plating solution to operating temperature also favors the dissociation of $Na_3Cu(CN)_4$ with the liberation of more free cyanide. This is in line with the observation by Read and Graham[21] that an increase in copper content of the bath has the same effect as an addition of free cyanide. The higher the concentration of $Na_3Cu(CN)_4$, the larger is the amount of sodium cyanide which is liberated when the solution is raised to operating temperature.

Zinc Plating Solutions

The Liebig analysis of a zinc solution made up from zinc cyanide, sodium cyanide and sodium carbonate, i. e., a brass bath without the copper constituent, should presumably give the free cyanide in excess of the compound $Na_2Zn(CN)_4$, since this is the stable complex. Sodium hydroxide is not added to low-*p*H brass solutions*: consequently, they are not subject to interference from this source. However, sodium carbonate, which is always present in brass solutions, may interfere. Also, as the free cyanide is removed during the course of the silver nitrate titration, a shift in equilibrium toward the lower coordination compound $NaZn(CN)_3$ is favored as shown in equation (6).

$$Na_2Zn(CN)_4 \rightleftarrows NaZn(CN)_3 + NaCN \quad (6)$$

In commercial cyanide-zinc plating solutions containing large amounts of sodium hydroxide, it is not possible to determine the free cyanide because the alkali reacts with the zinc cyanide complex to form zincate and liberate sodium cyanide[24,25].

$$Na_2Zn(CN)_4 + (2n + 2)\ NaOH \rightarrow Na_{2n}ZnO_{n+1} + 4NaCN + (n + 1)H_2O \quad (7)$$

This reaction is quantitative, and consequently in such solutions it is the total cyanide, i. e., the cyanogen equivalent to the zinc complex plus the free cyanide, that is determined by the silver nitrate titration. An excess of sodium hydroxide has little influence on the end point if potassium iodide is used as an indicator.

Brass Plating Solutions

Three different general methods have been proposed and are now used for determining the free cyanide in brass plating solutions.

Direct Titration Methods.—The sample is titrated with standard 0.1-*N* silver nitrate in the presence of potassium iodide indicator. There are several variations of this general method in the literature[26,28,29,31].

The "Guidebook"[28] recommends the same method for the determination of free cyanide in all cyanide plating solutions, including brass. This method which is essentially Thompson's procedure for copper, is given in Table II.

Pan[29] studied the effects on the amount of free cyanide obtained of several variables such as the dilution and amount of potassium iodide used in the titration and the carbonate and ammonia contents of the brass bath and recommended another direct titration procedure which is listed in Table II. He found that the amount of free cyanide obtained at the end point of his titration left only enough cyanide to combine with the copper and zinc present to form the complexes $Na_2Cu(CN)_3$ and $NaZn(CN)_3$. He therefore concluded that the copper and zinc in a brass solution exist only as these complexes[30]. Pan, however, did

*Some special brass plating solutions are made with sodium hydroxide and are operated at high *p*H[22,24]. The analysis for free cyanide in these solutions is complicated by the presence of an indeterminable amount of sodium cyanide liberated by the alkali from the sodium zinc cyanide complex.

TABLE II. SUMMARY OF SEVERAL METHODS IN THE LITERATURE FOR THE ANALYSIS OF FREE SODIUM CYANIDE IN BRASS PLATING SOLUTIONS

Method	Direct Titration*			Indirect Titration†		
Author	Guide-Book	Blum & Hogaboom	Pan	Heiman-McNabb	Clarke	Buchan
Reference	28	26	29	38	37	40
Sample size, ml	10.0	10.0‡	10.0	5.0	10.0	5.0
KI added, ml	5.0	10.0	14.3	20.0	10.0	5.0§
g/100 ml soln.	10.0	8.3	30.0	10.0	10.0	1.0
g	0.5	0.83	4.3	2.0	1.0	0.05
NaOH added, ml	....	....	....	20.0	....	5.0
g/100 ml soln.	....	....	....	20.0	....	20.0
g	....	....	....	4.0	3.0	1.0
H_2O added, ml in KI	4.9	9.8	12.7	19.5	9.8	5.0
in NaOH	....	....	....	19.4	....	4.7
in all reagents	4.9	9.8	12.7	38.9	9.8	4.7
to mixture	100.0	40.0	35.0*	40.0	70.0	....
total•	104.9	♦	50.0*	78.9	79.8	4.7
$AgNO_3$	0.1N	0.1N	0.1N	0.1N	0.1N	0.1N

*For a 10-ml sample, the free sodium cyanide in g/l equals number of ml of 0.1-*N* silver nitrate times 0.98.

†The free cyanide content was calculated as follows (for a 5-ml sample): The no. of ml of 0.1-*N* silver nitrate used in the titration multiplied by 1.96 equals the concentration, in g/l, of the free sodium cyanide plus the sodium cyanide equivalent of the sodium zinc cyanide, $Na_2Zn(CN)_4$. The latter may be found by multiplying the zinc content of the bath, in g/l, by 3.0. The free sodium cyanide is then obtained by difference.

‡Barium nitrate is first added to the sample to remove the carbonate.

§The NaOH and KI are in the same solution.

*Estimated by this author for an average titration.

•Total H_2O refers to total water added in KI and NaOH solutions and to the mixture. It does not include water present in the brass sample or in the silver nitrate solution.

♦Total water is indeterminable because of the variable amount of water added in the precipitation of the barium carbonate.

not investigate the effects of such other variables as *p*H, temperature, and iron content, which also have large effects[32]. While his conclusions were considered arbitrary and fortuitous and not generally accepted, they were never effectively refuted or clarified.

Hogaboom[33] found that sodium carbonate, a normal constituent of brass solutions, affects the value of free cyanide obtained by the direct titration. He recommended that the sodium carbonate first be removed with barium nitrate and that the titration be carried out on the filtrate with silver nitrate in the usual way[28]. The method is given in Table II. Hogaboom[34], in a discussion of this subject, stated that ferrocyanide interferes strongly in the titration.

Nölke[35] and Weiner[36] suggested a method for the direct titration of free cyanide, similar to the original Liebig method, i.e., without the potassium iodide indicator, in which standard zinc chloride is used instead of silver nitrate. The carbonate had to be removed prior to the titration, and the end point was the appearance of a turbidity of zinc cyanide. In evaluating this method, Clarke[37] first obtained promising results but later found that the method failed in the presence of iron in the brass bath owing to the false end point produced by the prior precipitation of zinc ferrocyanide. This method, as far as is known, is not used at all.

INDIRECT TITRATION METHODS.—It will be seen from the above discussions that many of the difficulties and the lack of agreement among the direct titration methods result from the instability of the zinc complex in the brass bath and not from the copper complex. Elimination of the zinc as a factor should give more consistent results.

Heiman and McNabb[38] suggested an indirect analysis of the free cyanide in brass solutions which consisted of titrating the sample with silver nitrate in the presence of potassium iodide indicator and excess sodium hydroxide. Both the free sodium cyanide and the sodium cyanide equivalent to the zinc in the zinc complex are thereby titrated; the copper complex is not affected. The zinc complex was assumed to be $Na_2Zn(CN)_4$.

It was shown that many of the difficulties of the direct titration were eliminated. For example the results were not affected by the dilution or the *p*H of the sample or by the carbonate or ammonia content of the brass bath. The optimum potassium iodide

and sodium hydroxide concentrations were determined experimentally. The recommended method is given in Table II.

A similar method was discussed by Springer[39], but he did not cite any experimental work, nor recommend a specific procedure. The zinc complex in the brass bath was considered to be $NaZn(CN)_3$, presumably on the basis of Pan's work[30].

Clarke and coworkers[37] made a considerable investigation of the various methods for the determination of free cyanide in brass solutions and found that the indirect titration method gave the most reliable results. They assumed the zinc complex to be $Na_2Zn(CN)_4$. Their recommended procedure is given in Table II. More recently Buchan[40] has also recommended the indirect titration method. The zinc complex was also assumed to be $Na_2Zn(CN)_4$. His particular procedure is also given in the same table.

Calculation Method.—The confusion and lack of accord among the methods for determining the free cyanide in brass solutions, as well as the uncertainties inherent in several of the methods, has fostered a school of thought which favors a rigid mathematical calculation of the "uncombined" cyanide on the assumption that certain copper and zinc complexes exist in the bath[42,43]. The exact values of the total sodium cyanide, copper, and zinc contents are determined by standard methods. The copper and zinc are assumed to be present in the bath as $Na_2Cu(CN)_3$ and $Na_2Zn(CN)_4$, respectively. The uncombined sodium cyanide is then calculated as follows: The copper and zinc contents of the solution multiplied by 2.31 and 3.00 respectively give the sodium cyanide equivalents in the cyanide complexes $Na_2Cu(CN)_3$ and $Na_2Zn(CN)_4$. The sum of these equivalents subtracted from the total effective cyanide content gives the uncombined or free sodium cyanide content.

This method is lengthy and inconvenient and requires a separate determination of the iron content.

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CHOICE OF ELECTRODEPOSITED COATINGS*

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Introduction

The field of commercial electrodeposited metallic coatings embraces about 18 different metals and alloys with widely varying physical and chemical properties. The metals range in hardness from such soft materials as lead and tin to those as hard as nickel and chromium. Chemically, they range in reactivity from such electronegative (anodic) metals as zinc and cadmium to the relatively inert noble metals, exemplified by gold and platinum. In color, electrodeposited coatings range from the white of zinc, cadmium and silver through the yellows of brass and the greens and reds of the gold alloys, to the black of platinum black and black nickel. Likewise, the electrical and magnetic properties of electrodeposited coatings vary greatly.

In addition to the wide range of physical and chemical properties obtainable in electrodeposited coatings by virtue of the inherent characteristics of the elemental metals themselves, in some instances it is possible to effect significant changes in the physical properties of individual metals by changing the conditions of deposition. For example, nickel may be deposited with controlled hardnesses ranging from 130 to 450 Vickers[1,2], while chromium deposits may be controlled at hardnesses of about 350 to 1000 Vickers[3,4].

Also, by the simultaneous deposition of two or more metals to form alloys or the successive application of layers of different metals (which may or may not be subsequently heat treated to produce alloys) coatings with special properties may be produced. For example, nickel-zinc alloy coatings exhibit electrochemical properties intermediate between those of the two metals composing the alloy[5]. Likewise, alloy deposits of cobalt and tungsten, developed for application to the interior of gun barrels, are reported[6] to exhibit notable wear- and erosion-resisting properties.

As regards corrosion protection, the different coatings vary, not only by reason of the particular metal or alloy deposited and the basis metal to which it is applied, but also with the thickness of the finish employed and the environment to which it is exposed.

In addition to the variations in properties of electrodeposited coatings, there are wide variations in the cost of applying them. It will be apparent therefore that the proper choice of a particular coating for a particular application cannot simply be a matter of "eeny, meeny, miney, mo", or chance, but requires the application of engineering knowledge of a specialized nature.

The purpose of this paper is to call to attention those factors which should be considered in the selection of electrodeposited coatings and to point out sources of pertinent information. Their role in corrosion protection will be covered in some detail. The importance of specifications will be discussed in a separate article.

Purpose and Use of Finish

The most important factors to be considered in the selection of any particular electrodeposited coating are (1) the purpose of the finish and (2) the use for which the finished article is intended. This involves not only the environment to which the finished article will be exposed but also its function, size and shape, cost, and expected length of useful life. If the finish is intended to enhance the appearance and serviceability of an expensive article intended for "lifetime" service, or if it is applied for functional reasons to a piece of engineering equipment designed to operate for 20 years, the requirements, obviously, will be vastly different than if the finish is applied merely to provide "sales appeal" for an inexpensive article which is not intended to have long life.

For the most part, electrodeposited coatings serve at least a dual purpose, one of which usually is to protect the basis metal from corrosion while the other varies with the application. For convenience of discussion the principal uses of electrodeposited coatings are grouped in the following classes:

Class 1 in which the primary object of the finish is to provide the article with a pleasing, durable finish for the period of its useful life. Here both the corrosion characteristics of the finish itself and its protective value are of particular importance. Perhaps the most familiar example of this class of coatings is the "bright work" on automobiles, plumbing fixtures and electrical appliances. This class of coatings is probably the largest of all, and their appli-

*This article is the first portion of a lecture delivered at a Symposium on Electroplating held during the Fall of 1947 at the Wayne University, Detroit, Mich.

cation constitutes the major part of the electroplating industry.

Class 2 in which the coating provides corrosion protection and at the same time serves in a functional capacity. Examples are the nickel-chromium coatings on telephone relays, where not only the corrosion protection of the basis metal and wear resistance of the surface are involved but the chromium on the pole faces also serves to provide a magnetic gap useful in controlling the operation of the relay. Another example from the communications industry is the electrodeposited gold finish on transmitter electrodes. Here the gold provides the required low contact resistance with the carbon granules and, by its protection of the brass basis metal and its own resistance to tarnish, assures continued proper functioning of the instrument for its intended life. Also in this class of coatings is the electro-tin finish used on tin-can stock. The thin tin coating serves to protect the steel sheets from corrosion in transit and temporary storage and provides a pleasing appearance to the outside of the can and corrosion protection to the inside. It also facilitates soldering the can seams and thus helps make possible high-speed production of food containers at low cost.

Class 3 in which electrodeposited coatings serve the purpose of corrosion protection alone, appearance or mechanical functioning being of no importance. The heavy zinc coatings applied to steel wire for use in aerial communication lines is an example of this class of coatings. Another is the heavy nickel coatings used extensively and to great advantage on the interior of steel pipe and other chemical-engineering equipment during the war[7].

Class 4 in which corrosion protection is of no importance but where the special properties of the coatings themselves serve an important function. Examples are (1) the iron, nickel and chromium deposits widely used to salvage worn or mismachined parts[8], (2) the chromium coatings applied to cylinders and other parts of internal-combustion engines for improved lubrication and wear resistance[9], and (3) the chromium coatings applied to the interior of gun barrels to minimize erosion[10]. Many applications of electrodeposited coatings to nonconductors[11] such as plastics and wood also fall into this class. Another interesting example in which the chemical rather than the physical properties of the coating are utilized is brass plating for improved adhesion of rubber to metals[12].

Corrosion Characteristics and Protective Value

As indicated in the classifications given above, the corrosion characteristics of the coatings themselves, as opposed to their protective value, may be paramount in determining their suitability for a given application. It may, therefore, be desirable to emphasize further the distinction between these two factors.

The protective value of an electrodeposited coating is a measure of its ability to protect the basis metal from corrosion. It depends upon several interrelated factors, including (1) the thickness and continuity of the coatings, and (2) the corrosion characteristics of both the coating and the basis metal, together with their electrochemical relationships, in the environment to which they are exposed. While a coating may be perfectly capable of providing the required protection, it may by reason of its own corrosion characteristics present a surface which is entirely unsuitable for the intended purpose. Thus, zinc coatings of proper thickness provide excellent protection to steel under most circumstances. But because of their tendency to darken and lose their lustre on continued exposure they could hardly be considered suitable finishes for automobile bumpers.

In general the corrosion characteristics of substantially continuous, or nonporous, electrodeposited coatings are essentially the same as for cast or wrought metals of the same composition. A knowledge of the corrosion behavior of the elemental metals and their alloys is a helpful guide in the selection of coatings for specific applications.

Effect of Environmental Factors

In considering electrodeposited coatings, the principal environment with which we are concerned is the atmosphere. There can be wide variations in that, however, as indicated below. When classified in accordance with their effect on the performance of finishes, atmospheric environments can first be divided into

(1) those in which the finish is directly exposed to the elements (outdoor exposure), and (2) those in which it is sheltered from rain, dew, etc. (indoor exposure). These, and especially the former, are generally further broken down into (a) industrial or urban, (b) marine or sea-coast, (c) tropical, and (d) rural.

In general, outdoor exposures are more severely corrosive than indoor exposures. Notable exceptions are humid indoor locations where condensation of moisture occurs on metal surfaces. Outdoor exposures are characterized principally by the effects of rain, dew, sun, and atmospheric contaminants. The latter may include both soluble and insoluble solids, liquids, or gases. On one hand the rain and dew together with the soluble materials provide an electrolyte which promotes galvanic effects normally absent in dry indoor locations. On the other hand, rain followed by the drying action of the sun and wind may under some circumstances be beneficial by washing off soluble dirt and corrosion products which otherwise tend to accumulate and promote further corrosion in humid locations. In connection with the relative corrosivity of outdoor atmospheric exposures, the observation that the period between 12:00 Midnight and 8:00 A. M. is much more severe than that from 8:00 A. M. to 4:00

P. M. or from 4:00 P. M. to 12:00 Midnight will be of interest[12].

In general, industrial and marine exposures are much more severe on coatings than rural exposures, with tropical locations falling somewhere in between. The behavior of lead coatings, discussed in greater detail below, presents a notable exception to this generalization.

Industrial or urban atmospheres are characterized principally by being contaminated with sulfur-containing gases and dust which are derived from burned fuel. Marine or sea-coast atmospheres, on the contrary, are characterized by their content of chlorides, and tropical locations by their relatively high temperatures and humidity. It will be apparent, however, that there are wide variations and combinations of these characteristics to which electrodeposited coatings may be exposed. In addition, the increasing use of calcium and sodium chlorides on northern streets and highways for ice removal presents a serious environmental hazard for plated coatings on automobiles. The heavy electrodeposited coatings which are used more and more in industrial applications, such as in the chemical and petroleum industry and paper mills, encounter special environmental factors in relatively strong corrosives and excess amounts of electrolytes.

Types of Coatings and Effects of the Basis Metal

When classified in accordance with their corrosion-protection characteristics, metallic coatings fall into two major groups, namely, (1) those which are electronegative (anodic) to the basis metal and (2) those which are electropositive (cathodic). In general, zinc and cadmium coatings constitute the principal electrodeposited finishes of the former type, while all the other commercially electrodeposited metals fall into the latter. It is to be emphasized that the particular value of the potential difference which may exist between the coating and basis metal depends not only upon the particular metals involved but also upon the environment to which they are exposed. The relative positions of the coatings and basis metal in the Standard Electromotive Force Series provides at best only a very rough indication of the difference in potential which may exist between them under actual service conditions and in some instances may be entirely misleading. The electromotive force series based on the potentials of metals in flowing sea water is a much more reliable guide[14]. But there again it should be realized that the potentials given apply only for the condition under which they were measured and that the relative positions of some of the metals may be reversed in other environments.

Electronegative coatings are characterized by their ability, in the presence of an electrolyte, to protect the basis metal at any discontinuities which may exist in the coating. The necessity for the presence of the electrolyte should be emphasized, as no galvanic protection can occur in its absence. It follows that the conductivity and amount of the electrolyte present plays an important part in the reaction. It can readily be demonstrated that in the presence of relatively strong electrolytes, such as immersion in sea water, electronegative type coatings are capable of sacrificially protecting the basis metal at relatively large discontinuities in the coating. The mechanism of the protective action which occurs at minute discontinuities, however, is not so well established. It has been postulated that as far as so-called "pinholes" are concerned, the corrosion protection characteristics of electronegative coatings are probably attributable more to their "barrier effect" and the fact that they are not cathodic than to their electronegative character[15].

Electropositive coatings, in contrast to those of the electronegative type, are characterized by their tendency to promote corrosion of the basis metal at discontinuities which may exist in the coating. As in the case of anodic coatings, the presence of an electrolyte is necessary for any galvanic action. In outdoor exposure, this is readily provided by rain and dew. In indoor exposures, it results from surface condensation of atmospheric moisture, which is probably accentuated by the presence of hygroscopic materials in the minute surface irregularities of some coatings. Since corrosion of the basis metal can be accelerated at any discontinuities in the cathodic coatings, their protective ability is a function of the extent to which they form a continuous envelope around the article to which they are applied. It will be apparent that this not only involves the continuity (porosity) of the deposit as initially applied but, insofar as the protective life of any given coating is concerned, also includes its rate of corrosion (decrease in thickness) in the particular environment to which it is exposed.

While the character of electrodeposited coatings as regards their continuity, etc., has not as yet been completely established with certainty, the evidence of the presently used test procedures leads most authorities to believe that very thin coatings, say those less than 0.0002 inch in thickness, contain discontinuities or "pinholes" which extend through to the basis metal[16]. It has been shown in numerous studies that the number of such discontinuities decreases very markedly with increase in thickness of the coating[17], and apparently they are not present in coatings more than 0.0015–0.002 inch thick. As might be expected, coatings of that order of thickness which initially exhibit no apparent porosity (at least by presently known test methods) may, and usually do in time, develop "pinholes" dependent upon their inherent corrosion characteristics in the environment to which they are exposed. Thus, it will be apparent that the electrochemical relationships between the basis metal and electropositive coatings play an important role in their protective value and emphasize the need for applying coatings of sufficient thickness to assure their continuity for the period of their expected useful life.

(*To be continued*)

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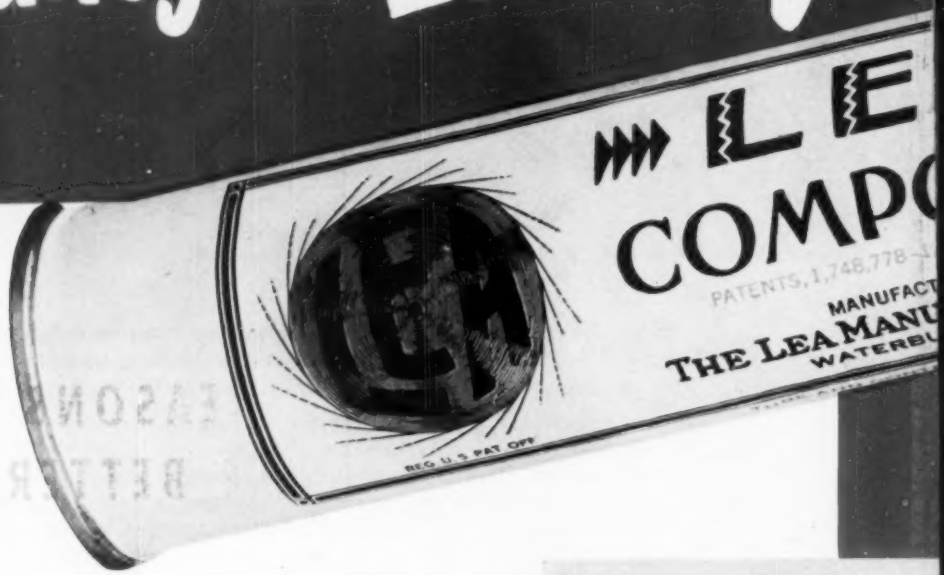

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j. e. Stareck

No list of important inventors in the field of electroplating would be complete without the name of Dr. J. E. Stareck. His many contributions to the industry are attested by numerous patents and publications. Even a casual conversation shows his inventive imagination, and soon one discovers that it is tempered by much practical sense.

Jesse Stareck was born in Petersburg, Mich. on March 17, 1905. While he was still a youngster, his parents moved to a farm in Kansas, and his early days there were those of the typical farm boy. After graduation from Benton High School in 1923, he entered the University of Kansas at Lawrence. During his undergraduate years he was elected to Sigma Xi, Tau Beta Pi, and Sigma Tau, honorary research and engineering societies, and was also active in Alpha Chi Sigma, professional chemistry fraternity. For relaxation he played the clarinet in the University Band.

Following graduation, he worked his way through the University of Kansas Graduate School as lecture assistant and assistant instructor in chemistry. He received his M.A. in 1930 and his Ph.D. in chemistry in 1934. While working on the thesis for his doctorate, Dr. Stareck discovered the method of color plating, later to become known as Electrocolor. In 1933 he was awarded the Roy Cross Research Fellowship to further his studies of color plating. The following year he became affiliated with the Kansas City Testing Laboratories and the Bar Rusto Plating Corporation in Kansas City, Mo, where he undertook commercial development of the color-plating process.

In 1935 he joined the research staff of United Chromium, Incorporated and has been with it ever since. At its Waterbury, Conn. laboratories he continued his research activities on Electrocolor and shortly afterwards developed the related process of electrodepositing patterns, known as Patternplate. For these novel contributions in the field of coloring metals the Franklin Institute awarded him the Edward Longstreth Medal in 1939.

In 1941, Dr. Stareck moved to the Detroit research laboratories of United Chromium as Director of Research. Some of the better known processes developed under his direction are Electrocolor, Patternplate, copper plating from pyrophosphate solutions, and high-speed chromium plating.

Dr. Stareck is an active member of many technical societies. He is a member of the Detroit Branch of the American Electroplaters' Society and has presented technical papers at the Society's conventions and many local branch and regional meetings. He is also active in the American Chemical Society, The Electrochemical Society, Electrodepositors' Technical Society, and the Engineering Society of Detroit. In the American Society for Testing Materials he is chairman of Subcommittee I of Committee B-8. He recently presented a new theory of corrosion of electrodeposited coatings before the Gordon Research Conference at Colby Junior College, New London, New Hampshire and is presently working on additional contributions for publication in this field.

For mental recreation, Dr. Stareck spends many evening hours on a favorite subject, atomic and molecular structure. His chief hobbies are golf and gardening (influence of his early farm life), with an occasional rubber of bridge. By good luck and a liberal handicap he won the company handicap golf tournament last fall but never expects to repeat the experience.

FINISHING MEN'S JEWELRY

AND

HABERDASHERY HARDWARE

THIS IS A STORY about skilled craftsmen using modern methods and equipment to produce men's jewelry and haberdashery hardware.

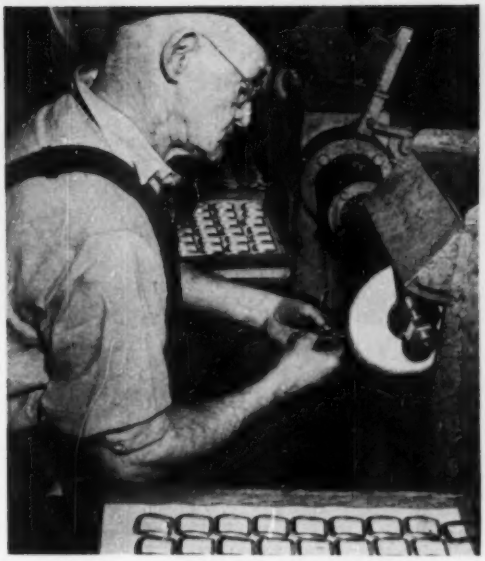
It began when the late S. Rae Hickok founded the Hickok Manufacturing Company back in 1909 and started making belts and buckles in a basement workshop. Through his vision and diligence the Company kept expanding, until today under the direction of his sons, Alan Hickok who furnished this story and Ray Hickok, it has become a leader in its field.

The Company's products are now greatly diversified and include wallets, suspenders and garters, and such jewelry as cuff links, tie bars, collar bars, and key chains. So that the little shaver can model his dad, Hickok also makes a complete line of these products for boys.

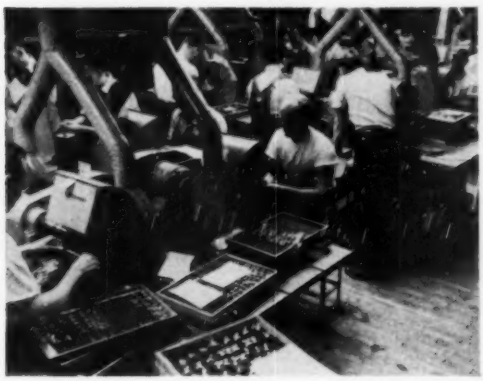
The metal products are manufactured and finished in the Metal Division under its superintendent, Elmer Nill. Extreme modernization has always been difficult to achieve in jewelry finishing, not only because of small lots and wide varieties of styles and finishes, but also because most jewelry finishers believe in stepping firmly in the footprints of their predecessors. However, the young and progressive leadership of this company has welcomed new techniques while still clinging tenaciously to high standards and traditional quality.

While skilled craftsmen and suitable equipment play an important part, modern methods require efficient processes controlled by process specifications. The Metal Division laboratory, staffed by four persons, is responsible for development of new methods, solutions, equipment, and analytical procedures; preparation of process specifications; maintenance of solutions by additions and purification; salvage of precious metals; and keeping of records and control of supplies. It has a complete pilot plating plant for process development; volumetric titration equipment, Fisher Electrophotometers, and Beckman *p*H Meters for analysis; and microscopes and other equipment for testing of finishes. Of special interest are the colorimetric methods of analysis which have supplanted many volumetric methods, especially for the analysis of gold-alloy solutions (see Karl Nell, PLATING **35**, 345–350 (1948) and The Mailbox in a forthcoming issue). Their use has shortened the time lag between analysis and corrective additions, greatly aiding in the control of color so important in jewelry finishing.

Buffing, coloring, and similar operations are carried out in two separate departments, one for relatively large parts and the other for small jewelry items. Here blanks are being buffed on a Parkermatic circular automatic before they are stamped into buckles and like items.

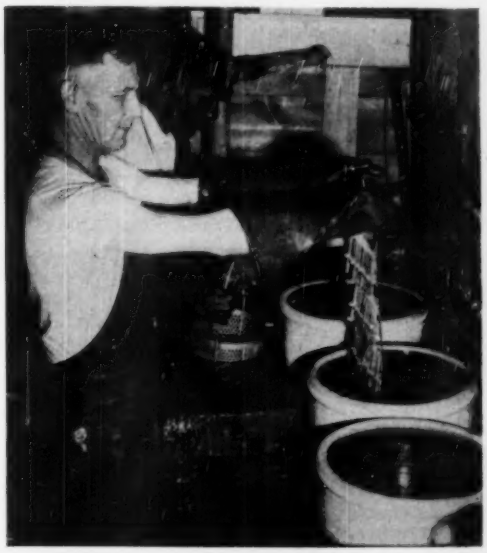


Buckles are being finished by hand.



In the acid dipping room (right), scale formed during annealing and flux and scale remaining after soldering are removed in scaling dips, and the surfaces are further conditioned in bright dips. Since four or five scaling or bright dips or both are required on some products, efficient control must be maintained over the dipping. Adequate cleaning prior to dipping is a "must". Parts must be handled carefully, and no foreign matter—dirt, oxide, maizo from the drying, water stain, or other film—must be left on the surface, expecially of parts dipped between press operations, such as before embossing, or parts ready for tumble finishing.

Jewelry buffing and coloring, in the second department (left), require many different wheels, compounds, and wheel speeds to produce a variety of finishes. Special finishing, such as satin and "oxidize" relieving, is also done here.



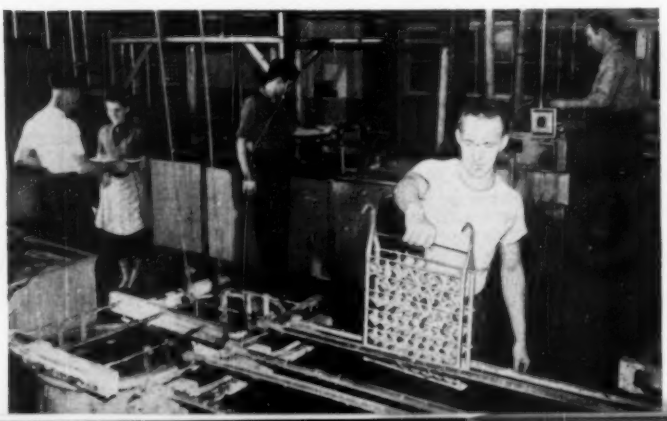
Belt hardware, such as tongue buckles and tongues, and brace hardware lend themselves well to deburring and finishing in bulk. Even some jewelry parts are being bulk-finished with good results following exhaustive tests and careful engineering. This picture shows a line of Roto-Finish barrels for deburring and smoothing parts of brass, steel, and zinc-base diecasting.

Ball burnishing usually follows to impart a lustrous finish. Thirty small barrels, which are especially suited to the existing variety of type of work, size of lots, and length of runs, and two large Abbott barrels are used.

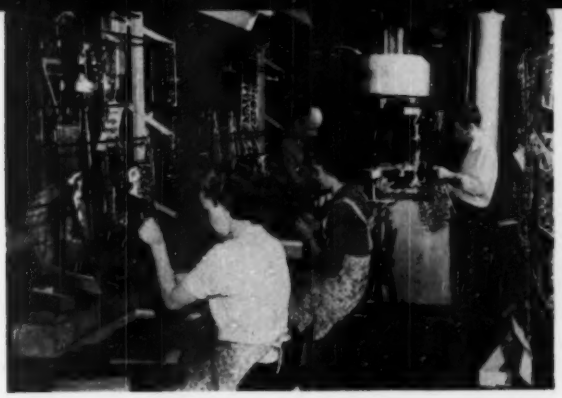
"Bronze" plating of high-copper, low-zinc alloy on previously copper plated steel and zinc-base diecastings, as well as on brass, is also done in the barrel-finishing department. Both the five-cylinder unit shown at left and a line of individual 30-inch barrels furnish a deposit of a color identical to that of jewelers' "bronze" (85–15 brass). Careful solution analysis and control is used to guarantee uniformity of color.

Relatively large parts are copper and silver plated in a separate department. Most copper plate—used as an undercoating for silver or "bronze" plate on steel, zinc-base diecasting, and soldered brass—is applied in the small barrels made of Lucite (bottom left). The transparency of this material makes it ideal for control of cleaning and plating of the zinc-base diecastings. Some barrel cadmium plating is also done in this department for protection of steel parts to be covered with leather.

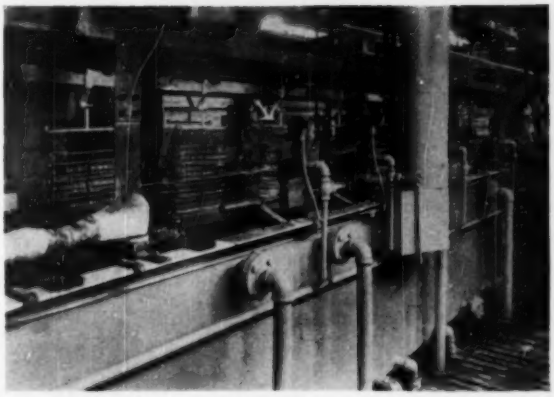
Silver plating is done in still tanks instead of automatics to permit deposition of silver of different degrees of brightness and variation in plating time. The plate is usually soft and semibright. This department (below) also cleans, washes, and dries buffed brass parts prior to lacquering, in a line which includes an emulsion cleaner (2 per cent Technisol), an electrocleaner, and a cyanide dip.



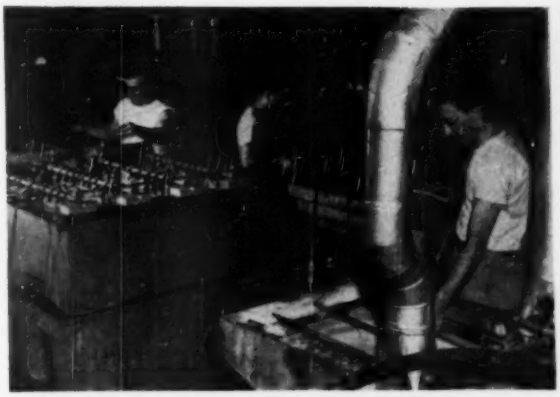
Racks are used to hold parts during cleaning and plating in the jewelry-plating department. Besides plating, there is also a setup for antitarnish treatment of silver by the Protectox method.



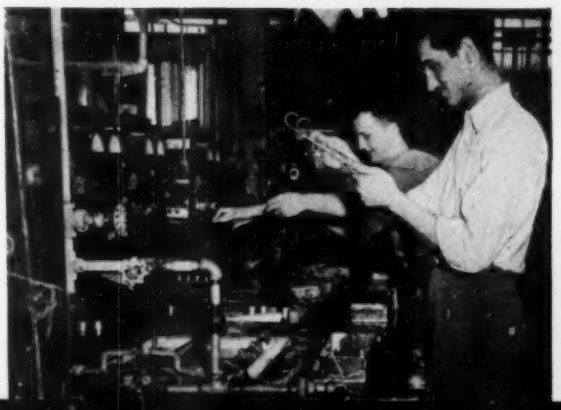
Automatic plating of jewelry is the newest development. Months of careful engineering planning were required to adapt successfully automatic plating to jewelry. This Udylite Junior machine has seventeen stations for cleaning, Udylite bright-nickel plating, and 18K gold plating.



The still plating line begins with a degreaser, air-agitated and mechanically agitated (vertical motion) soak-cleaner tanks, swabbing tanks, and copper and nickel tanks, all arrange to permit a wide choice of efficient cycles. The nickel solutions include Udylite bright nickel and cold semibright nickel containing Lustrebright, the latter bath being used for satin and two-tone finishes.



Gold still tanks in 24K, 18K and 14K golds, prepared from Technic soluble gold and nickel or copper cyanide or both for proper color and karat, and rhodium still tanks, with solutions made from Technic rhodium sulfate, are used either singly or, for two-tone jobs, in combination.



Belt and brace hardware and certain other products are racked and then sent through the machine in the background for dip lacquering with synthetic lacquer and for baking.

Most jewelry, after having been plated, is protected with a clear air-drying type of spray lacquer.

Inspection of jewelry items.

A corner of the laboratory where new methods are developed and tested and where processing is controlled by the most modern methods.

project no. 2

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Acknowledgment is due the Research Committee, Mr. William Tucker, Eastman Kodak Company, Chairman; the Research Directing Sub-Committee, Mr. B. C. Case, Hanson-Van Winkle-Munning Company and Dr. R. M. Wick, Bethlehem Steel Company, Chairman and Vice-Chairman, respectively; and the Project Committee, Dr. D. Gardner Foulke, Hanson-Van Winkle-Munning Company, Chairman, and Dr. Walter R. Meyer, Enthone, Inc., for their contributions to this project.

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Determination of Impurities in Electroplating Solutions

XIX. TRACES OF NICKEL IN COPPER PLATING BATHS

The purpose of this investigation was to find a rapid, accurate, inexpensive, and yet simple, analytical procedure for the quantitative determination of small amounts of nickel in copper plating baths. The method desired was one that would be applicable in the presence of such contaminants as calcium, lead, iron (ferric or ferrous), aluminum, cadmium, manganese, chromate, and silicate ions.

A survey of the literature revealed that, although there exist many methods for the quantitative estimation of traces or larger amounts of nickel, copper is always the interfering element. No satisfactory procedure had been developed, with the exception of that by Barry[18], who used the A. S. T. M. method[19] of electrodepositing the copper. This method, however, requires the presence of nitric acid, and since the oxides of nitrogen must first be removed[4] in the colorimetric determination of nickel, a long, tedious process of boiling down to fumes of sulfur trioxide is necessary to remove them.

Sandell[4] gives a method for the determination of traces of nickel which employs precipitation of the nickel with dimethylglyoxime, extraction of the precipitate with chloroform, and development of a brownish to wine-red color (depending upon the original acidity) with bromine water and dimethylglyoxime. Copper also gives a color with dimethylglyoxime, however, and interferes[1,4], although small amounts of copper are removed by dilute ammonium hydroxide.

Foulke[3] used a method similar to Sandell's and in a like manner removed small amounts of copper by shaking the chloroform extract with dilute ammonium hydroxide; he suggests that large amounts of copper be removed by precipitation with hydrogen sulfide. It was believed that this precipitate might occlude some of the nickel ions and give low results. Mellor and Thompson[2] state that in the precipitation of copper with hydrogen sulfide, the sulfide has a tendency to oxidize to form soluble copper sulfate.

Jones[12] colorimetrically determined small amounts of nickel by use of complex cyanide formation; however, copper also forms a cyanide complex and interferes.

Other organic reagents, such as potassium dithiooxalate, potassium dithiocarbamate, potassium dithiooxamide and formaldoxime, were not employed in place of dimethylglyoxime because most of the common ions interfere[6,9,10].

Nickel has been determined in the presence of copper by electrodeposition of the copper in acid solution and then of the nickel in ammoniacal solution (if present in suitable quantities). This method is long and tedious and would

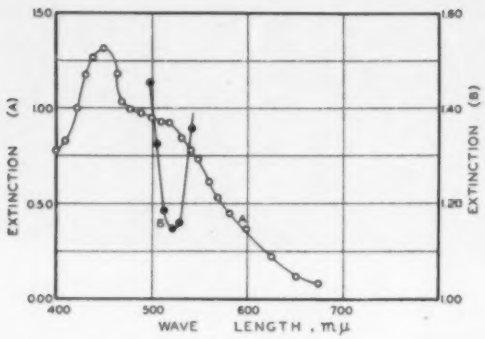

Fig. 1. Extinction vs. wave length for (A) the nickel dimethylglyoxime colored complex of approximately 200 mcg nickel per ml solution and (B) Klett-Summerson green filter No. 54 (extinction units on the right)

necessarily not be too accurate since only traces of nickel are present. Moreover, since a colorimetric method was sought, this method was not pursued[9-13].

A semimicro method for nickel in minerals is given[14] which involves precipitation with dimethylglyoxime, eventual indirect determination of the nickel by liberation of free iodine from potassium iodide, and titration of the iodine with standard sodium thiosulfate.

Satisfactory gravimetric methods are available if copper is absent. Several problems arise in connection with these methods because of the insolubility of dimethylglyoxime in water and the coprecipitation of iron and cobalt when present[1].

In weakly ammoniacal solutions copper yields with dimethylglyoxime a green precipitate which dissolves easily in an excess of ammonia. When coprecipitated with nickel, however, not all of the copper dimethylglyoxime is removed by the use of excess ammonia and the results are unreliable[1,15,16]. To circumvent this situation Balz[6] worked with a tartrate solution buffered with acetate. Grossman and Mannheim[17], however, state that some copper is always carried down mechanically.

As the literature search progressed, it became evident that in order that nickel be accurately determined, colorimetrically or by another method, the copper would first have to be removed or complexed.

A method for rapid removal of the copper would be to boil the bath with an aluminum triangle and plate out the copper on it, complex the aluminum ions by addition of tartrate or citrate, and then develop color according to the method of Sandell[4]. Although Heath[7] states that reduction of copper by aluminum is not satisfactory since it takes time, that precipitation is not always complete, and that particles of copper are easily lost and oxidized, utilization of this method for removal of the copper was attempted in conjunction with an extraction procedure patterned after that of Sandell[4]. Work in this direction was soon abandoned because some of the nickel plated out with the copper.

Balz[6] determined larger amounts of nickel in the presence of copper, aluminum, and iron by reducing these ions with sulfite, adding tartaric acid, and precipitating the nickel with dimethylglyoxime from a solution buffered with acetate. Precipitation cannot be done in alkaline solution unless copper is absent[9,11]. This method, linked with an extraction procedure, was attempted, but work was discontinued because the small amounts of nickel that are present in the bath were not precipitated under these conditions, although the copper was effectively complexed.

It was thought that the blue copper color could be decolorized in ammoniacal solution by complexing with cyanide. However, the nickel was found to form a tighter complex with cyanide than with dimethylglyoxime. Therefore, this idea was abandoned.

Since the copper could be removed quantitatively by electrodeposition in acid solution and the nickel would remain in solution[22], a method similar to Barry's[18] was next tried. In order to save time and tedious boiling down of the solution to remove the oxides of nitrogen, the deposition was conducted in sulfuric acid solution without the presence of nitric acid. Preliminary results were so encouraging that this method was developed more fully.

Developmental Work

A very simple method could be established if the following conditions could be met:

1. The copper must be deposited quantitatively without the presence of nitric acid. After several samples had been run and the absence of copper established by means of the sensitive copper-ammoniaion test, this condition was proven to hold.

2. The effect of interfering ions must be minimized. Addition of citric acid will prevent the precipitation of iron, aluminum, etc. The light yellow solution of ferric iron in alkaline citrate solution absorbs very slightly above 500 mμ. The nickel dimethylglyoxime solution, on the other hand, absorbs strongly in the neighborhood of 530 mμ so that by the use of a suitable filter, nickel may be determined in the presence of iron[4]. A green filter No. 54 was used for this purpose.

Measurement of absorption by Mitchell and Mellon[20] with a Coleman Universal spectrophotometer shows that the spectral transmission curve of nickel dimethylglyoxime has a minimum at about 445 mμ and a lesser minimum at about 543 mμ. The latter wave length is used in order to eliminate the interference of iron.

An absorption curve of nickel dimethylglyoxime was run with a Beckman spectrophotometer, and a maximum was found at 450 mμ. Due to the interference of iron at this wave length, it was decided to use a filter with a wave length above 460 mμ. A green filter No. 54 was chosen as it has a minimum of absorption at 520 mμ as shown in Fig. 1.

3. The color (and thus the transmittancy) of the nickel dimethylglyoxime solution must be reproducible. Readings were highly reproducible as indicated by preliminary calibration work. (See Table I.)

4. The color produced must reach a

TABLE I. CALIBRATION CURVE DATA

Nickel Added microgram	Colorimeter Readings			Average Reading	Blank	Corrected Average Reading
0	62.5	62.8	62.3	62.5	...	...
10	70.1	70.2	70.1	70.2	62.5	7.7
20	77.8	77.7	76.8	77.4	62.5	14.9
40	90.7	89.8	91.2	90.6	62.5	28.1
50	96.2	96.8	97.1	96.8	62.5	34.3
100	131.8	131.7	132.1	131.9	62.5	69.4
175	179.5	180.0	179.0	179.5	62.5	117.0

maximum within a reasonable period of time and have sufficient stability to be measured accurately.

A time study by Abbey[21] indicated that optimum time for reading is between two and five minutes after the color-forming agent has been added. This statement was verified by experiment. The color of the nickel dimethylglyoxime complex must be read within a few minutes[21].

It was found that approximately 1 ml of concentrated sulfuric acid must be added to the dilute bath when the copper is being electrodeposited in order that sufficient conductivity be provided for the passage of three amperes.

Tartaric acid was first used as the complexing agent for the contaminants remaining after the copper had been removed, but the results were more reproducible when citric acid was used.

With these conditions fulfilled, the next step in the experimental work consisted of the preparation of a calibration curve.

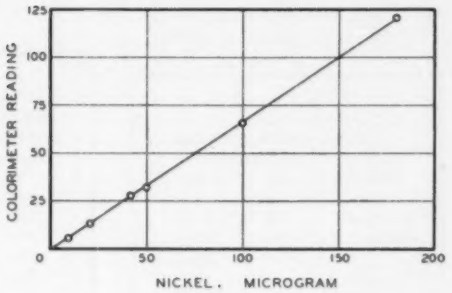

Fig. 2. Calibration curve for nickel by the nickel dimethylglyoxime method. Instrument used: Klett-Summerson colorimeter with green filter No. 54. Final volume: 100 ml

Preparation of the Calibration Curve

After it had been demonstrated that nickel in a pure copper sulfate bath can be successfully determined by the proposed method, a calibration curve was prepared. Various quantities of the standard dilute nickel solution were added to 1-ml portions of the copper sulfate bath. After dilution to a total volume of 60 ml, acidification and electrodeposition, the recommended routine procedure was followed as outlined.

The calibration curve in Fig. 2 was then constructed by plotting the corrected average readings against the concentration of nickel present.

It can be seen from the calibration curve, with 100 ml as the total final volume, that the readings on the colorimeter are very low in the region of 10–50 micrograms.

Recommended Routine Procedure

Reagents Required

1. Pure copper sulfate plating bath
   Dissolve 204 g cp $CuSO_4 \cdot 5H_2O$ crystals in approximately 500 ml of distilled water. Add 49 cp concentrated H_2SO_4 and dilute the mixture with distilled water to 1 liter in a volumetric flask.
2. Standard nickel solution—1 g/l nickel
   Weigh out 4.479 g reagent-quality $NiSO_4 \cdot 6H_2O$. Transfer to a 1-l volumetric flask and fill to the mark with distilled water.
3. Dilute standard nickel solution—0.01 g/l, or 10 microgram/ml
   Pipette 10 ml of stock (1-g/l) nickel solution into a 1-l volumetric flask and dilute to the mark with distilled water.
4. Citric acid solution—10 per cent
   Weigh out 10.0 g reagent-quality citric acid crystals (pulverized if necessary), transfer to a reagent bottle, and add 90 ml distilled water.
5. Bromine water—saturated
   Saturated bromine water can be prepared by the addition of approximately 4.2 g bromine (cp quality) to 100 ml distilled water. Add sufficient bromine to 100 ml of water in a bottle, so that some bromine remains at the bottom of the bottle. The solution is then saturated.
6. Dimethylglyoxime solution—1 per cent
   If the sodium salt is available, distilled water is used as the solvent, otherwise ethyl alcohol must be used as solvent. Dissolve 1 g of either the salt or the dioxime itself in 99 g of solvent.
7. Sulfuric acid—concentrated, reagent quality
8. Ammonium hydroxide—concentrated, reagent quality

Apparatus Required

1. Klett-Summerson colorimeter with green filter No. 54 or its equivalent
2. Fisher-type electroanalyzer or similar electrodeposition apparatus, with platinum anode and cathode
3. Volumetric flasks of 1000- and 100-ml capacity
4. One 1-ml, two 2-ml, one 5-ml graduated in tenths, one 5-ml, one 10-ml pipettes with syringe bulbs
5. One 10-ml and one 100-ml graduates
6. Test tubes matched for colorimetric use of ½-inch diameter, 15-ml capacity
7. Beakers of 150-ml capacity
8. Split watch glass
9. Standard wash bottle

Procedure

A. Preparation of Blank

1. Pipette 1 ml of the pure copper sulfate plating bath into the 150-ml electrodeposition beaker.
2. Add sufficient distilled water to make the total volume approximately 40 ml.
3. Add 1 ml concentrated H_2SO_4 with a graduate.
4. Electrodeposit the copper for ten minutes using 3 amperes.
5. Transfer the solution to a 100-ml volumetric flask.
6. Wash the beaker several times with distilled water from the wash bottle, but avoid use of excessive amounts of water.

If electrodeposition equipment is not available, an alternative method for removing copper is as follows:

(a) *Pipette 1 ml of the pure copper sulfate plating bath into a 100-ml beaker.*
(b) *Add sufficient distilled water to make the total volume approximately 50 ml.*
(c) *Add 10–15 g granular tin metal.*
(d) *Heat for ten minutes.*
(e) *Cool and filter the solution into a 100-ml volumetric flask.*
(f) *Wash the tin metal several times with distilled water and filter the washings into the volumetric flask.*
(g) *Add concentrated H_2SO_4 dropwise to the filtrate until the filtrate becomes clear.*
(h) *Proceed with steps 7–14.*

7. Pipette 5 ml of the 10 per cent citric acid solution and mix.
8. Add saturated bromine water until a yellow color persists and mix.
9. Add approximately 2–3 ml concentrated NH_4OH and mix the solution well. If the yellow color from the bromine addition of step 8 still persists, add a few more drops of NH_4OH until all the color has been removed. Then add a few extra drops of NH_4OH, so that the solution will be ammoniacal.
10. Pipette 2 ml of 1 per cent dimethylglyoxime solution.
11. *Shake immediately and thoroughly.*
12. Dilute to the mark with distilled water and read within 5 minutes.

B. Measurement of Transmittancy

13. Using a clean test-tube cell filled

TABLE II. IMPURITIES ADDED TO THE PURE BATH

Impurity	Quantity mg/100 ml	Concentration g/l
Aluminum	100	1.0
Calcium	saturated	saturated
Chromic oxide (CrO_3)	20	.2
Lead	5	.05
Iron	100	1.0
Silver	100	1.0
Silica	100	1.0
Sodium	200	2.0

with distilled water as the reference liquid, adjust the colorimeter so that the galvanometer pointer is at the zero position when the dial reading is zero.

14. Pour out the distilled water, rinse the test tube several times with small portions of the colored solution from step 12, and refill the test tube with this solution. Replace the test tube in the colorimeter and rotate the dial until the galvanometer pointer returns to its original position. Record the scale reading. This scale reading constitutes the blank for the method, and an average of three determinations should be used as the final blank value.

Preparation of Calibration Curve

Readings for the 10, 20, 40, 50, 60, 80, and 100 micrograms of nickel are obtained in the following manner:

I. Add 1, 2, 4, 5, 6, 8, and 10 ml, respectively, of the dilute standard nickel solution (0.01 g/l nickel) to a series of 150-ml electrodeposition beakers.

II. With each beaker, carry out steps 1–14 inclusive of the routine procedure as outlined.

III. Subtract the blank reading determined as outlined from the readings for the solutions containing the nickel. Plot the corrected readings against the nickel concentrations.

Measurement of Unknown

The transmittancy of the unknown solution is obtained by following the procedure outlined for the determination of the blank, substituting the copper sulfate bath of unknown nickel content for the pure copper sulfate bath in step 1. The blank reading is subtracted from the reading for the unknown solution, and the net reading is converted to nickel concentration with the aid of the calibration curve.

Since these solutions, in the recommended range of concentrations, transmit light in accordance with Bouguer-Beer's Law, it is not necessary to prepare a calibration curve, though this is always the safest procedure. If the scale on the colorimeter is logarithmic, the simplified procedure indicated in the following example may be used:

Example

Blank reading = 60
Reading for 100-microgram nickel standard = 130
Reading for unknown = 140
Corrected reading for standard = 130 − 60 = 70
Corrected reading for unknown = 140 − 60 = 80

$$\text{Nickel content of unknown} = \frac{100}{70} \times 80 = 114 \text{ mcg/ml bath, or } 114 \text{ ppm}$$

"Stop and Go" Method

For those who lack a colorimeter and desire a visual-comparison method for the determination of nickel, the following is recommended:

1. Develop the color in an unknown and in a series of standards containing 30, 50, 70, and 90 micrograms of nickel by the method described in the "Recommended Routine Procedure".
2. Compare and match the intensities of the colors of the solutions as viewed transversely against a white background, and estimate the concentration of the unknown solution to within 20 micrograms.

Accuracy and Precision of the Method

To determine the accuracy of the method under conditions similar to those that might be met industrially, small amounts of metallic salts were added to the bath to simulate possible industrial impurities. The kind and quantity of the impurities are found in Table II.

The silica was added in the form of Na_2SiO_3 and the metallic ions as chlorides or nitrates. The mixture was heated, shaken well, and then cooled. The insoluble material was filtered out, using a No. 40 Whatman filter paper. The impure bath had a green cast, caused by iron and the chromium impurities.

TABLE III. ACCURACY AND PRECISION DATA

Nickel Added microgram	Colorimeter Reading	Blank	Corrected Reading	Nickel Found microgram	Error microgram	Error per cent
100	129	62	67	97	−3	3
100	133	62	71	103	+3	3
100	129	62	67	97	−3	3
100	130	62	68	99	−1	1
100	128	62	66	96	−4	4

Table III shows the results obtained when such an impure copper plating bath was analyzed according to the procedure described. It can be seen that the average accuracy of the method is 3.5 per cent, with a greatest single error of 4 per cent, and that the precision of the method is 2.1 per cent.

An additional check on the accuracy and precision of this method was obtained by sending samples of a test solution to several concerns for analysis by this method. The organizations which kindly consented to test the method were: MacDermid, Inc., Waterbury, Conn.; Wierton Steel Company, Wierton, W. Va.; Armco Steel Corporation, Baltimore, Md.; and Technic, Inc., Providence, R. I.

Their results and those obtained by the writers are shown in Table IV.

TABLE IV. RESULTS OBTAINED BY COOPERATING LABORATORIES

Laboratory	Nickel Found microgram
A	97.0
B	101
C	101
D	100
E	92

From the above table, it can be seen that these results constitute a very good

Determination of Impurities

check of the method—all agreeing within 4 per cent.

Applicability of the Method

This procedure can be adapted to the determination of nickel in copper cyanide baths through the use of an additional step. The cyanide bath is first made acidic by adding sulfuric acid and the hydrogen cyanide boiled off. After this has been done, the procedure given in this paper is followed.

Discussion

The copper must be removed quantitatively before one proceeds to determine the nickel colorimetrically; otherwise the blue color of the copper ammonia ion will develop when the solution is made ammoniacal and incorrect readings will result. The method is accurate to 5 per cent.

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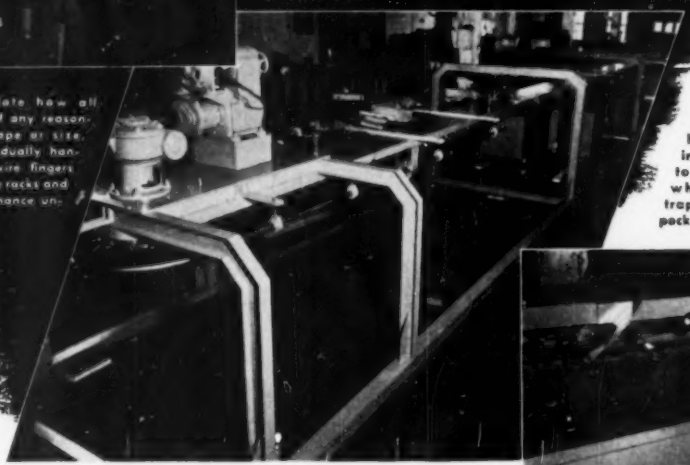

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readers' questions of general interest

Q. 84 We plate reflectors for photo-flash equipment. These are made of brass, highly buffed on the inside and heavily soiled on the outside. We have tried pre-cleaning with an emulsion cleaner, but trouble was encountered in bright nickel plating, apparently because of its poor rinsability. Soak cleaning followed by electrocleaning was not enough without hand swabbing. Our present method is (1) vapor degrease and clean-solvent spray in a basket; (2) wipe the inside; (3) rack; (4) soak clean for three minutes; (5) direct and reverse electroclean; (6) cold rinse; (7) dip in 10 per cent sodium cyanide solution; (8) cold rinse; (9) dip in 10 per cent by volume sulfuric acid; (10) cold rinse; (11) bright-nickel plate. Unfortunately the results are inconsistent. What would you recommend?

A. Buffed brass parts are conventionally prepared for nickel-chromium plating by degreasing or by emulsion or soap soaking; electrocleaning, either anodically, or cathodically followed by short anodic cleaning; warm and cold rinses; an acid dip and a rinse, or preferably a cyanide dip or cyanide-copper strike, a rinse, an acid dip, and a rinse. The important thing is to discover what cleaner concentration, temperature (about 175° F), current density, and time that will do the job in combination with the other steps in the cycle. Possibly your difficulty is in the racking; the racks must be such that an adequate current density be had on the reflector backs. Perhaps the buffing compound contains a high percentage of an unsaponifiable high-melting-point grease, in which case it should be changed.

If the caked-on buffing compound is not removed in the pre-electrocleaning step it may help to soak the parts in bulk in kerosene or high-flash-point petroleum solvent first.

All tests should be performed with fresh cleaner. Trouble which may be experienced later with a good cycle would then be known to be associated with accumulation of soil in the cleaner or possibly depletion of cleaner ingredients. Variability in cleaning results may be caused by reaction between fatty acids in the buffing compounds and the brass if the buffed parts are all owed to stand overnight prior to cleaning—A. K. GRAHAM.

Correction

Q. 78. The temperature of the zinc-immersion treatment solution in step 7 of the first answer should be 70° F, not 170° F as shown in the March issue.—EDITOR.

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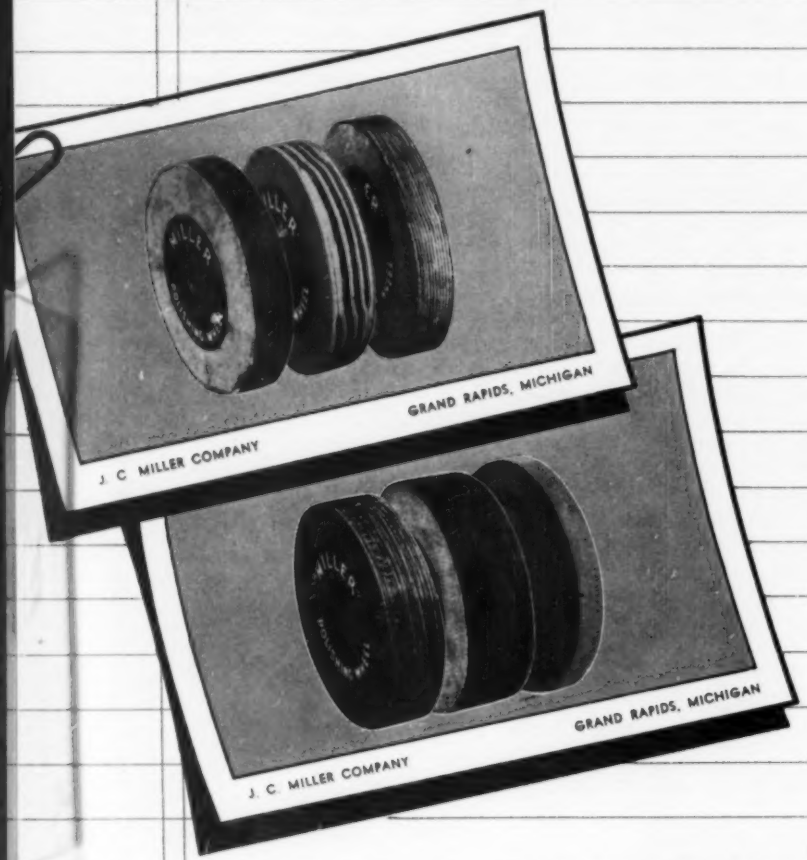

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Book Review

DR. HAROLD J. READ
Associate Professor of Metallurgy, Pennsylvania State College

HYDROGEN IN METALS by Donald P. Smith, xiii + 367 pages, 1948. The University of Chicago Press, Chicago 37, Ill. Price, $10.00.

The investigator who chooses or is forced to concern himself with the phenomena which occur when hydrogen is brought into contact with metals faces not only an intrinsically difficult problem but also a great mass of accumulated information and misinformation which he must survey before a start can be made. Dr. Smith's excellent monograph, based on 1,467 literature references and his own extensive experience, will prove to be of inestimable value in the study of the literature. Emphasis has been placed on the review of experimental observations and the deductions which can be made directly from them. Highly theoretical speculations, although covered in the bibliography, are referred to in detail only in special instances where they may be required in the discussion of experimental results.

The first thirteen chapters are topical with respect to occlusion phenomena and related matters, i. e., instead of covering all aspects of the behavior of a given metal towards hydrogen and then passing on to another, the author has chosen to break down the behavior pattern into several major divisions wherein pertinent data are discussed for all metals. This sometimes means that the reader must search rather extensively in the volume for all information on a given system, but the arrangement does have many logical advantages when the subject matter as a whole is considered. In the final formal chapter is found a resume of the conclusions which may be drawn from the experimental evidence presented in the preceding chapters and a discussion of some of the problems which remain to be solved.

The book is distinctly not suited for casual, light reading. The complex nature of the subject matter, the author's terse style, and his use of extensive cross-references in the interests of brevity require the closest attention on the part of the reader. Some of the most provocative information is to be found in the supplemental notes which are located at the end of the book and are keyed into the main text. Fortunately, the author has used a paragraph numbering system which permits rapid location of the many cross-references. There is every evidence here of very careful organization and thorough study of the source material.

There are many direct references to electrodeposited metals in which hydrogen has been occluded as a result of the plating operation, and it is obvious that the book will be very useful to investigators in this field. Perhaps it should be added that there is little or nothing which will be of value to those interested only in practical plating.

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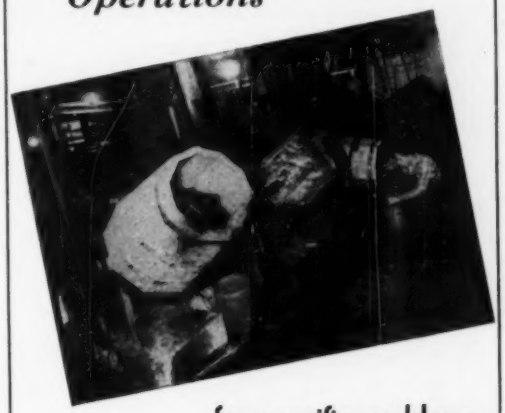

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Article Abstracts

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The Surface Treatment of Aluminum and Its Alloys by Anodic Oxidation. S. T. M. Johnstone. Council Sci. Ind. Research (Australia), Div. Aeronautics Report SM-116 (1948), 23 pp. Met. Abst. 17, 81 (October, 1949).

A useful survey of the composition, structure, sealing, dyeing, thickness, absorption, hardness, abrasion, corrosion-resistance, and industrial applications of anodized coatings. The chromic, sulfuric, and oxalic acid anodizing processes are briefly described, and some comments are included on the mode of action of the electrolytes and the effect of the composition and nature of the base metal on the nature and appearance of the oxide coatings. 32 ref.

Present Position of the Surface Protection of Light Metals. E. Nachtigall. Arch. Metallkunde 2, 194–197 (1948). Light Metals Bull. 11, 1015 (October 21, 1949).

Treatments for magnesium- and aluminum-base alloys are reviewed. The electrolytic treatments of magnesium have only limited advantages over the chemical treatments and at the same time are much more expensive. Metallic coatings on magnesium alloy suffer from the high electrode-potential difference between the coating and the basis metal. An interesting development is the coating of magnesium-alloy parts with resinous organic compounds of magnesium. These coatings, which have excellent corrosion-protective and other properties, are formed by treating the magnesium-alloy parts in boiling alkaline solutions of organic compounds under pressure.

Unlike the case of magnesium alloys, the chemical treatment of aluminum alloys (M. B. V. and E. W. processes) is of lesser importance. On the other hand, anodic treatment is widely used. In addition to the better known processes, reference is made to the Flussal process (fluoride-containing solution) which produces comparatively soft and thin films. The process has found specialized applications, for example, for the treatment of the interior of light-alloy oxygen cylinders, where the ductility of the films and the throwing power of the bath are advantageous. The Bessal process, in which a solution of oxalic acid in glycol is used with a potential of 200 volts, produces brown films unsuitable for decorative purposes, but which have been used on screws, taps, pistons and other parts where their considerable thickness of 0.0016 inch (40 μ) and resistance to abrasion are of advantage.

Potential and Solubility of Copper in Solutions of a Nickel Electrolyte. B. V. Drozdov. Zhurnal Prikladnoi Khimii 22, 56–61 (January, 1949).

Influence of individual components of the solution, particularly of chloride salts and of pH, on the potential of the coppper electrode was established. The temperature coefficient of change of potential was found to be equal to that found earlier for copper sulfate.

Properties and Significance of Cobalt Coatings. A. Kufferath. Arch. Metallkunde **2,** 135–136 (October 7, 1948).
Includes, in addition to the above, a discussion on the defects of cobalt electroplates, their causes, and methods of elimination; also the simultaneous deposition of nickel and cobalt. 11 ref.

The Anodic Oxidation of Aluminum in Oxalic Acid Solutions of Different Compositions. A. von Zeerleder and W. Hubner. Chimia **3,** 77–84 (April 15, 1949).
Effects of a series of above solutions were investigated over ranges of *p*H values, temperatures, and voltages. Results are tabulated and shown graphically on two- and three-dimensional diagrams.

Transformation of Gamma to Alpha Manganese. E. V. Potter, H. C. Lukens, and R. W. Huber. J. Metals **1,** sec. 3 (Metals Transactions **185**) 399–404 (July, 1949).
Changes in structure and resistivity of electrolytic manganese as it is transformed from ductile gamma to brittle alpha manganese were determined. Discusses transformation theory and transformation rates. Data are tabulated and plotted.

Determining Uniformity of Zinc Coatings on Steel Wires by Dipping Them into Copper Sulfate Solutions. Hubert Hoff and Georg von der Dunk. Arch. Eisenhuttenwesen **20,** 135–138 (March–April, 1949).
Explains and critically evaluates the accuracy of the above method, showing that it fails to furnish definite information about the corrosion resistance of the material under natural conditions. Data are tabulated. 16 ref.

New Torch Licks Problems of Flame-Spraying Polythene. W. B. De Long and E. V. Peterson. Chem. Eng. **56,** 123–125 (June, 1949).
Describes and diagrams torch and procedure for applications to steel. Gives corrosion-test results which show that the coatings are nonporous, adherent, and corrosion resistant, in contrast to those applied by other methods.

Polishing: Recommended Procedures for Ferrous and Non-Ferrous Metals. Recommended Methods for Aluminum, Silver and Electroplates. G. F. Weill. Metal Ind. **74,** 407–409 (May 20, 1949); 442–444 (June 3, 1949).
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abrasives. Gives detailed recommendations for each of the common types. Concluding installment discusses special procedures necessary for aluminum and its alloys.

Automatic Buffing of Plated Hub Caps. A. H. Allen. Steel **124,** 62–64 (June 27, 1949).
Describes and illustrates completely automatic setup at Ford.

Electrodeposition of Rhenium from Aqueous Solutions. L. E. Netherton and M. L. Holt. J. Electrochem. Soc. **95,** 324–328 (June, 1949).
Discusses the above with emphasis on semiquantitative information about cathode current efficiencies.

Notes on the Temperature Control of Steam Heated Plating Plant. Anon. Electroplating and Metal Finishing **2,** 377–385 (June, 1949).
Describes and diagrams arrangements for control of bath temperatures.

The Purification of Plating Solutions. Part III. (Conclusion.) G. T. Colegate. Electroplating and Metal Finishing **2,** 417–423, 425–426 (June, 1949).
Deals with copper, brass, speculum, zinc, cadmium, tin, silver, chromium, gold, and rhodium solutions.

Automatic Plating Control. Bath Operation at Constant Current Density. D. Ashby. Metal Ind. **74,** 483–485 (June 17, 1949).
Reports important developments in the automatic control of rectifiers for operating a bath at constant current density regardless of area of the work. Automatic control equipment for chromic acid anodizing was developed.

A Review of Methods for Coating-Thickness Determination. R. S. Bennett. Instruments **26,** 209–216 (June, 1949).
Presents various methods of nondestructively measuring the thickness of thin coatings on bases of a different material, usually mild steel. Two instruments recently developed for use in the plating industry are described, and results are compared.

Interferometric Determination of the Apparent Thickness of Thin Metallic Films. D. G. Avery. Nature **163,** 916 (June 11, 1949).
Outlines results of some experiments using the method described by Khamsavi and Donaldson in 1947. Results show that measurements of the thinner film thicknesses obtained by this method should be treated with caution, since errors of the order of at least 30 per cent may occur.

Studies on Copper (I) Cyanides. Bo Norberg and Bertil Jacobson. Acta Chemica Scandinavica **3,** No. 2, 174–178 (1949).
Reactions between cupric and cyanide ions were investigated. 11 ref.

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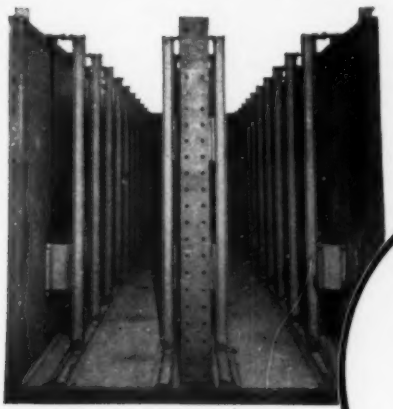

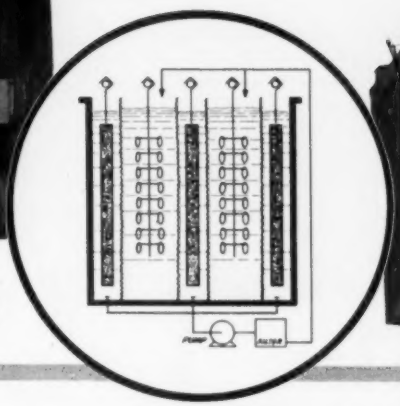

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Article Abstracts

Spectrophotometric Study of Complex Formation Between Cupric and Sulfate Ions. Reino Nasanen. Acta Chemica Scandinavica **3**, no. 2, 179–189 (1949).

The Effect of Sodium Hydroxide Upon the Electrodeposition of Electrodialyzed Kaolin. James L. Gabbard and Maurice R. Thompson. J. Electrochem. Soc. **95**, 329–343 (June, 1949).
Fractions of electrodialyzed Georgia kaolin of definite particle-size range were prepared by centrifugation and employed to make suspensions for obtaining *p*H titration curves with NaOH as base. Using the same partly neutralized suspensions from *p*H measurements, corresponding yield upon electrodeposition was determined. Data are tabulated, plotted and discussed.

Hydrofluoric Acid Versus Construction Materials. Chem. Eng. **56**, 233–234 (August, 1949).
Part I of a symposium, in which a representative group of construction materials are evaluated for services involving hydrofluoric acid, consists of the following articles: "Carbon and Graphite", by J. F. Revilock; "Chlorimets", by Walter A. Luce; and "High-Silicon Irons", by Walter A. Luce.

How To Do Buffing and Polishing. Jerome L. Bleiweis. Am. Machinist **93**, 105–112 (August 11, 1949).
Special section gives details of equipment and procedures, including a discussion of the relative merits of hand or automatic polishing.

Drawing Compounds and Other Variables in the Rinsing of Metal Cleaners. Louis A. Pavlish. Enamelist **26**, 3–7 (Summer, 1949).
Rinsing between the cleaning of steel and its immersion into the sulfuric acid pickle has been given little consideration in porcelain enameling. A modification of the regular pickling procedure was used to determine the effects of various rinsing variables: addition of drawing compound to cleaner; carry-over of cleaner to rinse; flanged parts; transfer time between cleaner and rinse; and temperature of rinse. Results are illustrated.

Pickling, Etching, Re-treating, Rust Removal, and Rust Preventives. IV. Richard Springer. Metalloberflache **2**, 271–275 (December, 1948).
Briefly describes literature and patent references for the years 1935–1943. This installment consists of sections on pickling in the enameling industry, pickling and pickling apparatus, and regeneration of spent pickling baths.

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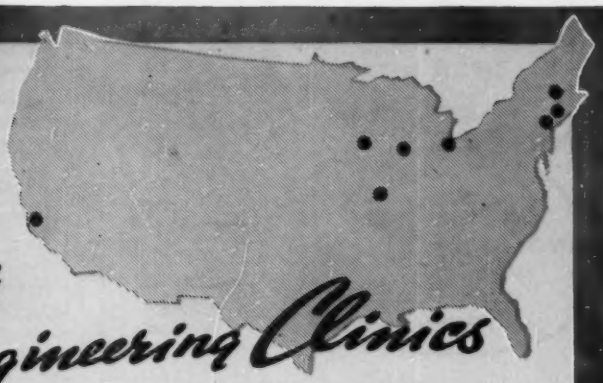

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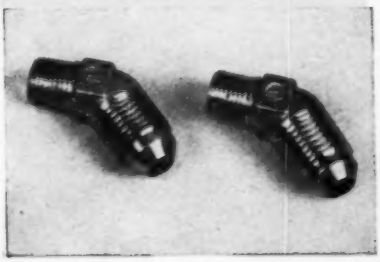

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See page 9
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What kind of cleaner attracts both oil and water? How does this help remove buffing compound residues and pigmented drawing compounds? *See page 8.*

What are the advantages of reverse current for electrocleaning steel? *See page 15.*

For nonferrous metals, what are relative advantages of cathodic, cathodic-anodic and soak-anodic cleaning? *See page 17.*

Can you electroclean brass without tarnishing? *See page 18.*

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Patent Abstracts

GEORGE B. HOGABOOM

Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents, Washington 25, D.C. Price 25 cents each.

No. 2,492,204, December 27, 1949—Electrodeposition of Gold on Tantalum—R. D. Van Gilder, assigno rto U. S. of America as represented by the Secretary of War.

It is the object of my invention to provide a method by which tantalum grids for electronic tubes may be electroplated with a very thin but strongly adherent gold film which will withstand all stresses and strains which the grid has to undergo while in operation.

CLAIM 1. The method of electrodepositing a strongly adherent gold film on tantalum grids of electronic tubes comprising heating said tantalum grid in a vacuum to a temperature of approximately 1900° C, allowing said tantalum grid to cool after it has reached said temperature, electrodepositing a gold film on said tantalum grid from an electroplating-bath solution consisting essentially of gold chloride, sodium cyanide and water, rinsing the plated metal from said electroplating-bath solution and heating said plated grid in a vacuum to a temperature of approximately 1100° C.

CLAIM 2. . . . heating said tantalum grid with induction heating coil in a vacuum . . .

2 claims.

References cited: U. S. Patents 765,371; 1,803,691; 2,093,845; 2,107,277; 2,116,927; 2,133,995. French Patent 797,485. "Electrodeposition of Metals", by G. Langbein (1924), pp. 510, 511, 512. Trans. Electro-Chem. Soc. **23**, 32–34 (1913). "The Metal Tantalum", Fansteel Metallurgical Corporation, N. Chicago, Ill. (1939), pp. 4, 9. Ind. Eng. Chem. **27**, 1166–1167 (1935).

No. 2,497,988, February 21, 1950—Indium Plating—D. F. Green and J. E. Salmon, London, England, assignors to Vandervell Products Limited, London, England.

Examples of suitable stable baths prepared according to the principles of our invention:

Potassium

Indium (as a freshly made chloride)	30 g/l
Dextrose	30 g/l
Total KCN, initially	80 g/l
Free KCN, maintained	60 g/l
Total KOH, initially	140 g/l
Free KOH, maintained	90 g/l
Room temperature	20° C
Cathode current density	3 amp/dm²
Anode	inert

Rate of deposition	21 mg/amp–min.
Cathode efficiency	86%

The same solution at 80° C gave an efficiency of 95 per cent.

Sodium

Indium (as freshly made chloride)	30 g/l
Dextrose	30 g/l
Total NaCN, initially	50 g/l
Free NaCN, maintained	20 g/l
Total NaOH, initially	80 g/l
Free NaOH, maintained	40 g/l
Room temperature	20° C
Current density	2 amp/dm²
Anode	inert
Rate of deposition	19 mg/amp–min.
Cathode efficiency	78%

The same solution at 80° C and the same current density gave an efficiency of 95 per cent.

CLAIM 1. An aqueous indium cyanide dextrose electrolytic bath for electrodepositing indium consisting of from 5–40 grams per liter of indium, 5–40 grams per liter of dextrose, with a ratio by weight of dextrose to indium of 1–1, a cyanide of the group consisting of sodium cyanide and potassium cyanide of from 1–5 times the weight of indium present, and the corresponding hydroxide of the above cyanide in quantities of 6–135 grams per liter.

6 Claims.

References cited: U. S. Patents 1,849,293; 1,965,251; 2,237,948; 2,423,624. British Patent 573,848. Trans. Electrochem. Soc. 65, 377–380 (1934). Iron Age, December 19, 1940, pp. 35–38. Metal Finishing, July, 1944, pp. 405–407. Chemical Age, October 6, 1945, pp. 314–315.

No. 2,499,231, February 28, 1950—Method of Producing Surface Conversion Coatings on Zinc—Jesse E. Slareck, assignor to United Chromium, Inc.

This invention relates to transparent surface-conversion coatings on zinc and methods for producing the same.

EXAMPLE I

Production of a yellow surface-conversion coating on zinc

(zinc article as anode)

Bath Solution:

$Na_2Cr_2O_7 \cdot 2H_2O$	175 g/l
Na_2CrO_4	25 g/l
Na_2SiF_6	Excess of solubility
$SrSO_4$	Excess of solubility
*p*H	5.5–6
Current density	3–30 asf
Temperature	70° F

Removal of yellow color

Bath	hot water
Temperature	212° F
Immersion time	5–15 minutes depending on thickness of coating

The hot water bath may be speeded in its activity

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Volts	125	R.P.M.	600
	K.W. 4		

Generator

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	K.W. 80		

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Volts	125	Amps.	1200
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Crocker Wheeler Synchronous Motor

K.V.A.	175	Phase	3
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Volts	440	Amps.	230
	Serial No. 587189		

Exciter

Volts	115	R.P.M.	1750
Amps.	26	K.W.	3
	Serial No. 1955251		

Motor

Type	KT 160	Amps.	66
Cycles	60	H.P.	5
Volts	440	R.P.M.	1750

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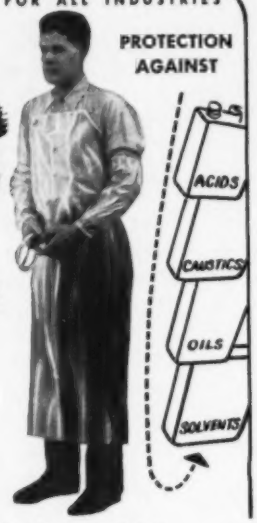

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by addition of a conducting salt, such as, for example, a carbonate, silicate, phosphate, borate, and others.

CLAIM. A method of making surface-conversion coatings on zinc, which are formed by passing current at 2 to 50 amperes per square foot to the zinc surface connected as anode, immersed at room temperature in an aqueous solution consisting essentially of a soluble chromate and a silico-fluoride auxiliary acid radical in a proportion of Cr^{VI} to SiF_6 within the range 20:1 to 60:1 and having a *p*H between 3 and 7 and made transparent so as to exhibit the color of the underlying metallic zinc, which comprises soaking articles having said surface-conversion coatings thereon in hot water until the coating becomes transparent.

1 claim.

References cited: U. S. Patents 1,827,247; 1,853,323; 2,021,592; 2,035,380; 2,060,192; 2,288,007; 2,313,456; 2,433,723. German Patent 706,347. Gilman, "Inorganic Reactions" (1929), p. 265.

No. 2,499,807, March 7, 1950—Process for Electroplating Molybdenum and Its Alloys—L. F. Yntema and Mary Joecile Kszychi, assignors to president and board of trustees of St. Louis University, St. Louis, Mo.

An electrolyte is made of the following compositions:

EXAMPLE I

6 g molybdic anhydride
60 g KOH
55 cc NH_4OH (28% NH_3)
75 cc HCO_2H (87%)
15 cc H_2O
*p*H 5.7
C.D. 0.5 amp/cm²
Temperature 30–40° C

Preferably the bath is subjected to a preliminary electrolysis at a current density of 0.5 amperes per square centimeter until it becomes red in color.

6 examples.

CLAIM 1. The process of plating metallic molybdenum which comprises passing a current between an anode and the work to be plated as a cathode in an electrolyte comprising an aqueous solution of a compound of a class consisting of molybdic acid, its anhydride and its salts and a high concentration of an anion of an aliphatic acid of the class consisting of formate, acetate and proprionate, the ratio of said anion to water being between 1 to 2 and 1 to 4 and the *p*H being between 5.5 and 6.8.

CLAIM 9 . . . and a soluble salt of a metal to be codeposited with molybdenum of the class consisting of iron, nickel and cobalt, in which the ratio of anion of said aliphatic acid and salt of said aliphatic acid to water is between 1 to 2 and 1 to 4, the *p*H being between 5.5 and 6.8, the temperature being between 30° and 50° C, and maintaining the current density between 0.07 and 1.0 ampere per square centimeter.

References cited: Classen and Hall, "Quantitative Analysis by Electrolysis" (1913), p. 146. Trans. Electrochem. Soc. **70**, 423, 424 (1936).

No. 2,499,808, March 7, 1950—Process for Electroplating Molybdenum and Its Alloys—L. F. Yntema and Mary Joecile Kzychi, assignors to president and board of trustees of St. Louis University, St. Louis, Mo.

CLAIM 6. The process of electrodepositing molybdenum alloys which comprises passing a current between an anode and the work to be plated as a cathode in an electrolyte comprising an aqueous solution of molybdate compound of the class consisting of molybdic acid, its anhydride and its salts, a concentration of fluoride ion at least several times the concentration of said molybdate compound, and a soluble salt of a metal to be codeposited with molybdenum of the class consisting of iron, nickel and cobalt, at a temperature between room temperature and 65° C and maintaining a current density of between 0.2 and 0.4 ampere per square centimeter.

References cited: Chem. Abst. **35**, 1326[8] (1941). J. Am. Chem. Soc. **54**, 3775–3776 (1932).

No. 2,500,205, March 14, 1950, Method of Plating—R. A. Schaefer, assignor to The Cleveland Graphite Bronze Company, Cleveland, Ohio.

The present invention relating as indicated to a method of plating is more particularly directed to the provision of a method of electrodepositing a layer of metal or metallic alloy onto the concave surface of semicylindrical articles and to maintain a sufficiently uniform thickness of deposited metal so that for many articles and for many uses the variation in thickness, particularly in thin deposits, will make unnecessary or cheapen and simplify any subsequent metal-removing operations, if required. The term "uniform" as used herein is defined to mean a degree of uniformity in which the variations from the average is not more than 5 per cent in thickness circumferentially and the variation in thickness at right angles thereto is substantially zero for approximately 90–95 per cent of the extent of the deposit.

CLAIM 1. In a method of electroplating a uniform layer of metal of approximately 0.005 inch or less thick upon the concave surface of a semicylindrical article, the steps which consist of placing the parallel edges of the article against and with the concave side facing an insulating barrier element having a slot opening parallel to and centrally located with respect to the lateral edges of the article and being otherwise impervious to the passage of current, the width of said slot being approximately 25 per cent or less of the diameter of the article, immersing the article and barrier element in an electroplating bath, mounting an anode in the bath external to the article, and passing plating current from said anode to said articles as a cathode through said slot.

5 claims, 7 figures.

References cited: U. S. Patents 1,587,303; 1,603,951; 1,757,671; 1,765,320; 1,872,221; 2,086,226. British Patents 986; 255,736; 335,161.

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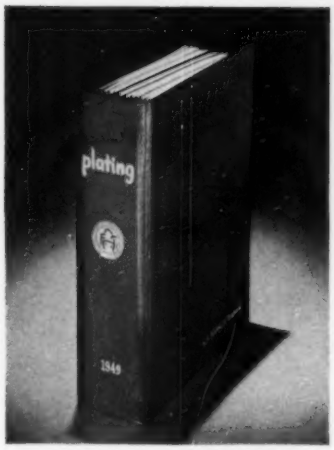

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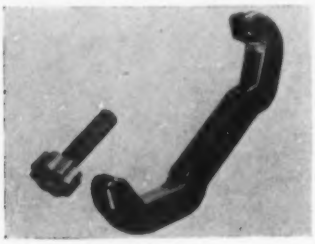
Equipment and Supplies

E—462. Plating Barrel Clamp—An improved low-cost plating-barrel clamp of Merlon construction called Type C has been announced by the Hanson-Van Winkle-Munning Company, Matawan, N. J. The advantages of the new clamp include



two-part construction compared to six parts in the clamp formerly available; simpler operation, being provided with an adjustable screw to take up contraction or expansion; absence of metal parts, eliminating possible metal deposit.

The clamp will be of molded construction for all 14-inch cylinders, cut to order for other sizes. For further information, use Reader Service Card.

E—463. Electroformed Paint Spraying Mask—Close-fitting paint-spray masks, that are produced by electroforming directly over the part to be painted, are available from Vertrod Corporation, Brooklyn, N. Y. This stiff, durable mask is said to conform closely to the surface of the object, thus reducing or eliminating bleeding of edges, fogging, etc. For further information, use Reader Service Card.

E—464. Polishing Wheel Cement—A polishing-wheel cement for use with all types of abrasives on all types of metals has been introduced by The Nevel Company, Detroit, Mich. This cement is reported to resist high temperatures resulting from heavy-duty grinding and polishing operations and to be useful for recoating belts. For further information, use Reader Service Card.

E—465. Rotary Centerless Brushing—"Centerless Brushing" is a new technique developed by Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland 14, Ohio, for preparing cylindrical parts for easier precision assembling. It makes use of special round Master spiral brushes in a typical centerless grinder to blend ground surface sharpness. For further information, use Reader Service Card.

E—466. Clear Lacquer for Silver—The Egyptian Lacquer Manufacturing Company, South Kearny, N. J., and Lafayette, Ind., has introduced a new silver lacquer "26-CN" for compacts, cigarette cases, costume jewlery, novelties, and plated ware. It can be sprayed or dipped. Characteristics are said to be water-white finish, crystal-clear film, remarkable toughness, exceptional sulfide-tarnish resistance. For further information, use Reader Service Card.

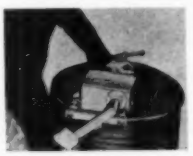
E—467. Corrosion Resistant Coating—Specialty Coatings Laboratory, 1721 N. Water Street, Milwaukee 2, Wis., has developed a V-200 series of plastic-base coatings to solve specific corrosion-proofing problems. A simplified coating system to protect chemical or processing equipment from strong corrosive fumes, the V-200 coatings are available clear or in colors and may be applied by spray, brush, or dip to be quickly air dried or baked and yield a flexible, abrasion-resistant coating highly adherent even to polished metal surfaces. The coverage is said to be approximately 250 sq ft per gallon per mil thickness. For further information, use Reader Service Card.

E—468. Buffer and Polisher—Warner Electric Company, 1512 Jarvis Avenue, Chicago 26, Ill., announces a bench-size buffing and polishing unit designed especially for electroplaters, jewelers, and laboratories.

An outstanding feature is the built-in Vacumatic Dust Collector System with a high-velocity mill-wheel-type exhaust fan that instantly removes wheel ravelings, grit, and dust from the work area and disposes of them in the air-filter collecting bag.

The complete unit is 20 inches long by 8½ inches deep by 11½ inches high. The buffing shield is designed to accommodate any wheel up to 8 inches in diameter. For further information, use Reader Service Card.

E—469. Head Cutter for Steel Drums—A manually operated Head Cutter that cuts cleanly the head of any size drum in approximately one minute has recently been introduced by Michael A. Schinker Manufacturing Company, 6514 S. Western Avenue, Chicago 36, Ill.



The cutter will work equally well on empty or filled drums, from 10 to 55 gallon sizes and 20 to 16 gauge stock. Turning of the crank causes it to complete the circle of the drum. The head will drop into the drum while the cutter remains resting on the open drum. The cut leaves no ragged edges and the metal is flanged slightly inward. The cutter blade will cut about 1000 heads before dulling and can be resharpened.

The Head Cutter also doubles for sealing leaky chimes when the cutter wheel is replaced with a roller wheel. For further information, use Reader Service Card.

E—470. Bench Tumbler—American Plating Rack Company, 232 N. Rosemary, Inkster, Mich., offers a portable bench-type tumbler of welded construction. The

hexagon may be either in oblique or horizontal position, as required. For further information, use Reader Service Card.

E—471. Stopoff Plugs—Duggan Masking Devices, Dept. PM, 230 W. Fort Street, Detroit 16, Mich., announces a new development, a set of conical molded-neoprene "Caplugs" which may be used either to cover a protruding stud or to plug a hole. Made with a molded conical hole which makes them easy to insert and remove from a stud or threaded bolt, they are available in five sizes. For free sample kit of all sizes and price list, use Reader Service Card.

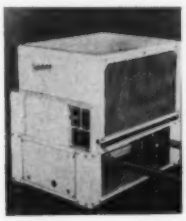
E—472. Chemically Resistant Fabric—Gra-Lite fabric, developed by the Standard Safety Equipment Company, 232 W. Ontario Street, Chicago 10, Ill., is said to combine the best features of protection, comfort, and durability demanded of a safety material. With Gra-Lite compound, it is possible to seal garment seams completely and prevent chemical seepage. Even under freezing temperatures this fabric retains its flexibility. New design features in garment tailoring and the inherent texture of Gra-Lite prevent binding and clinging.

Gra-Lite compound thoroughly penetrates the fibers of the base fabric which makes it highly abrasion resistant and withstands harsh cleaning agents. It will not mildew or rot. Complete impregnation also provides chemical resistance on the inner surface of the material. For further information, use Reader Service Card.

E—473. Rustproofing Coating—The International Rustproof Corporation, Cleveland, Ohio, announces a new "homogenizing" process for its nondrying rustproofing product, Ircolene No. 19. Homogenizing is said to increase greatly its corrosion-resisting qualities.

Humidity and salt spray tests on the improved product, with 95 per cent relative humidity at 95° F, show a minimum film life of 5000 hours. On salt spray tests (20 per cent NaCl at 95° F), minimum film life is 150 hours. In both tests a coating of zinc phosphate under Ircolene No. 19 more than doubled film life.

Ircolene No. 19 is also used extensively by industry to protect nonferrous metals from staining and tarnishing and to maintain top condition while in storage. For further information, use Reader Service Card.



E—474. Temperature Controller—A new temperature-control device that automatically holds fluid temperatures within a range as narrow as ±½° F has just been announced by Pako Corporation, 1010 Lyndale Avenue N., Minneapolis, Minn.

The unit, named Pakotemp, circulates a tempering liquid rapidly through a jacket or tempering panels surrounding the critical fluid. Incorporated in the unit is a stainless-steel heat exchanger which automatically provides heat or refrigeration as required to hold the temperature of the critical fluid within predetermined limits. Thermostatic and electrical controls are said to be conveniently located, eliminating the hazards of electrical connections on solution tanks. Complicated mixing valves or manual controls are also eliminated. For further information, use Reader Service Card.

E—475. Manually Operated Polarograph—A new manually operated Polarograph, Model III, is announced by E. H. Sargent & Company of Chicago, Detroit and Dallas. While it may be used in any phase of Polarography, it is particularly recommended (1) for such routine analyses where only one substance is determined and where the step shape approximates a pure form, characteristic of reversible reactions involving simple ions in fairly substantial concentrations, (2) for amperometric titrations, and (3) for educational institutions where the 315 mm long, readily visible scale and the simplicity of design make it ideal for demonstrations. For further information, use Reader Service Card.

E—476. Spraying Primer—Stantite Spraying Primer, a product of The Stanley Chemical Company, East Berlin, Conn., is a new type of rust-inhibiting primer and preparation coating designed for use under either air-dried or baked finishes. It is said to have excellent adhesion to steel, stainless steel, galvanized iron (with no previous treatment), zinc, nickel, cadmium, brass, copper, aluminum (anodized or not), magnesium, glass, many molded items, and old finishing systems which are firmly attached to the surface to be coated.

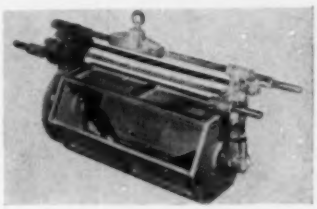
The adhesion of all types of top coats to this new spraying primer is claimed to have proved excellent. This includes air-dry and baked lacquers, vinyls, alkyds, ureas and melamines, enamels, japans, paints, etc. For further information, use Reader Service Card.

E—477. Water Displacing Rust Preventive—A new water displacing type of rust preventive known as Sealbrite is being introduced by London Chemical Company, 607 S. Dearborn Street, Chicago 5, Ill. Exceptionally durable protection is claimed for inter-operational and finished-product storage, insuring the manufacturer of a clean bright surface to his customers.

Sealbrite is reported to have passed 30-day condensation tests under alternating conditions of high and low temperatures and humidity, using polished steel blocks two-inch cube, as well as the standard thirty-day humidity cabinet and thirty-hour salt-spray tests. The coverage is between 2700 and 3200 square feet per gallon.

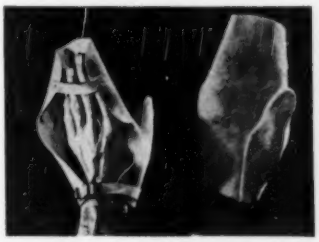
Sealbrite is applied by a cold dip or spray operation. After dipping, the water on the metal pieces is displaced by a perfectly dry protective film. The water drops to the bottom of the tank and can be drained off periodically. The film is easily removed with ordinary petroleum naphthas even after the end of one year. Its fingerprint-neutralizing properties eliminate the need for reprocessing and prevent rusting under the film. Sealbrite can be used as a corrosion inhibitor on black-oxidized, phosphated, or untreated metal surfaces. For further information, use Reader Service Card.

E—478. Ribless Barrel Plating Cylinder—The Hanson-Van Winkle-Munning Company, Matawan, N. J., announces the development of a Mercil Type Merlon



Ribless Cylinder in 14 x 30-inch size for use with all commonly employed plating solutions. Holding 15 per cent more work than any conventional plating cylinder of the same overall size, the ribless cylinder is of hexagon shape, has no ribs, no tie rods, and no tie-rod tubing. Merlon sheet stock is utilized for the covers, with a dovetailed slot milled along the edge of each. The joining is made by a dovetailed piece of Merlon driven into each slot. The heads and ends of the covers are milled with a ¼-inch groove and in assembly a ¼ x ½-inch Merlon key is fitted into the slot of the cover and also the head. The heads are joined to the ends of the covers with two flat-head screws in each cover. This cylinder employs flexible dangler, hair-pin dangler, or disc type contacts. The cylinders have been in successful operation for a considerable time in a large screw-manufacturing plant where maintenance costs were greatly reduced because of simplified construction with fewer parts to be replaced. For further information, use Reader Service Card.

E—479. Leather Hand Pad—The GS Safti-Mitt Handpads are adjustable to any size and have snap-fastened strap



which keeps pad on and makes removal easy. Cool and comfortable, workers are said to like them. Made of heavy horsehide for long wear, they are available from General Scientific Equipment Company, 27th and Huntingdon Streets, Philadelphia 32, Pa. For further information, use Reader Service Card.

A. E. S. News

A Branch's Contribution to the A. E. S. Research Program

Industrial research might be likened to insurance; we all recognize their benefits, but few of us can afford to carry as much of each as we like.

When one considers the tremendous progress in the standard of living already brought about by industrial research since it became a guiding factor in American industry, one's first thought might be that only minor improvements are left to be made. The truth is that commercial research is so new it has just begun to function. This statement is particularly true when applied to the electroplating industry. Only a very few years has there been a conscious organized effort to search for new scientific knowledge which can be utilized practically. In the plating industry, research is just beginning to develop its own methods and tools. It is working today with instruments which were virtually unknown a few years ago. No one in the plating industry can say what the imagination of the men who use this equipment may discover in the next ten years, but anyone acquainted with research work knows that the surface has hardly been scratched. So little is known about so many phases of electroplating, and so much remains to be done.

Through the organized effort of the American Electroplaters' Society many of us are in a position to contribute to its Research Program in a material way and reap the reward in new practical ideas and methods applicable to our present operation. All of us recognize the value of such work, and inasmuch as the individual obligations are so small, it should not be difficult to find many who will support it.

The Chicago Branch, recognizing both the advantages to be gained and its obligations as a Branch of the Society, has endeavored to contribute time and money to the furtherance of this work. During the past five years it has contributed to the Research Program $1.00 annually for each member. This is paid as a per capita tax. In addition, during the last two years it has contributed $100.00 in each year to be used as required. This year it is contributing $100.00 directly to the Research Program.

The Chicago Branch is also contributing to the Chicago Branch Research Committee an additional sum of money to be used to publicize the Research activities and for solicitation of new sustaining members to support the Program. For several years it has assumed the expense of mailing, printing, etc., required by its Research Committee.

With the stake we have in the plating industry and its future, we welcome the opportunity to contribute to a program dedicated to the advancement of our industry.

R. F. Ledford,
Chicago Branch

Sustaining Membership Campaign

The roster of sutaining members continued to grow through March and has now reached 226.

The following joined since publication of the list in the April issue:

Crane Company, Chicago, Ill.

Crown City Plating Company, Pasadena, Calif.

Hall-Mark Company, Los Angeles, Calif.

Howard Plating Industries, Inc., Royal Oak, Mich:

George I. Nichols Plating, Los Angeles, Calif.

Price-Pfister Brass Manufacturing Company, Los Angeles, Calif.

Their support of A. E. S. Research is most appreciated.

A. E. S. 37th ANNUAL CONVENTION

Hotel Statler, Boston — June 12-15

Boston—A Good Place for a Good Time

Friends of the A. E. S.:

Last month you had the wisdom of the Editorial Board displayed in a prospectus for the Boston Convention. You may have some interest also in the solemn rites that will be performed outside the educational sessions.

The standard program items will not, of course, be missing. The International Fellowship Club's Open House on Monday evening, the fluent hospitality of our supplier hosts throughout the Convention, and the Annual Banquet which will wind up the whole on Thursday evening are the good old staples. Here we can only hope to live up to the high standards of our predecessors. We'll do our best—and it may be a pretty good best. Joe Duffy has lined up Tedesco, a championship course in the rolling hills of the near North Shore, for the golf tournament: he says it will be a (deleted) good tournament with a break for everybody and that whoever forgets his clubs and shoes will bitterly regret the oversight. Dave Clarin will M.C. for Aunt Ella at luncheon with his usual suave mastery, and Plato will entertain at the Thomson Club in connection with the Wednesday Outing.

The Outing will be held at Nahant, a huge pile of rocks at the end of a couple of miles of sandy beach overlooking Boston Harbor. Swimming is fine for polar bears only, but paddling is available, and our virile athletes will contest softball and horseshoe championships to the cheers and razzberries of the unambitious. At the end of the afternoon, when the golfers have returned from nearby Tedesco, the celebrated Kendall will pull the steaming seaweed off the clambake pit, and clams, lobsters, and general fixings will be at your disposal. Generous bibs will be passed around, but just the same, wear your old clothes; this is the kind of meal that splashes.

For Tuesday evening we have Electroplaters' Night at the Boston Pops. The Convention has the whole floor of Symphony Hall, where light refreshments can be had at little tables while Arthur Fiedler and the world's best orchestra* play for us the gay and lively music that everybody likes. Boston at its best.

Our Ladies' Committee, sensing that the mysteries of plating have too long been reserved to a single sex, has arranged a technical session where the girls will be brought up level with the ignorance of their men folks. On Monday a sightseeing tour will show off the historical and educational high spots of the city, and for Tuesday there is arranged a ten at Mrs. Jack Gardner's Museum and a conducted tour through this Italian palace of Renaissance times, transplanted bodily into the lovely Fenway.

The General Program derives an international flavor from the cosponsorship of the Electrodepositors' Technical Society; we have already a number of European reservations. The Founder Members of the Society will be honored at the opening session, and the same session will hear an epoch-making address by Dan Gray, the Sage of Oneida, which is expected to echo down the corridors of time.

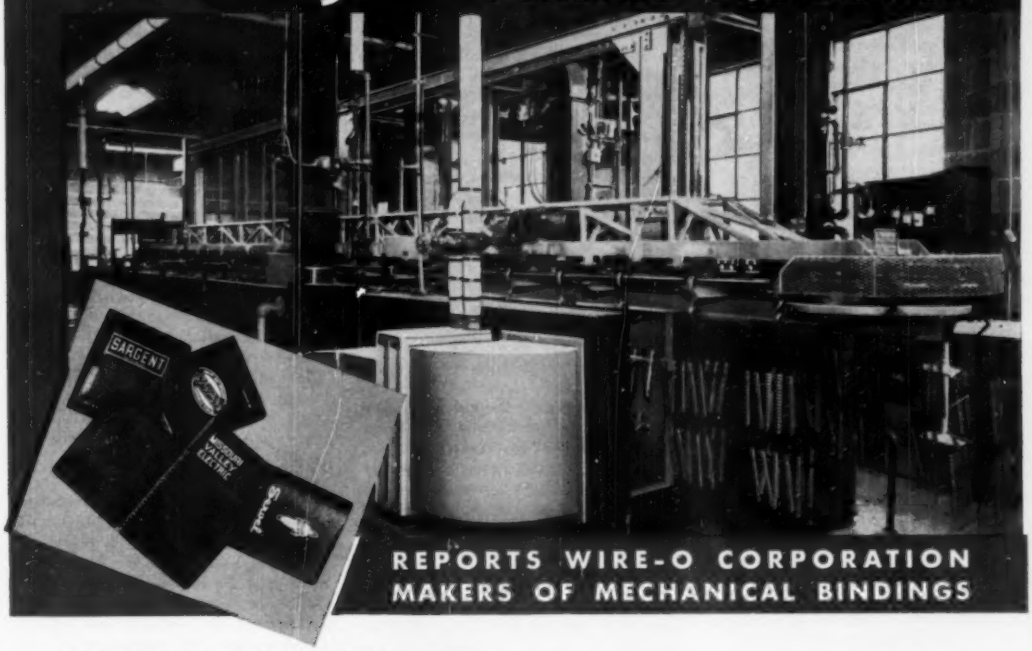
The Convention Committee wishes here to make special acknowledgment of indebtedness to the suppliers to the industry. In a very real sense, they will be your hosts. The ten-dollar registration does not begin to meet the outlay planned for this June, and in the absence of commercial exhibits and paid program advertising our friends are coming forward with substantial underwriting. They are the sponsors of our festivities.

June is a lovely month in New England. Boston is a good place to enjoy life. And the early rush of reservations suggests that Everybody You Ever Knew will be at the Statler on June 12 to help you take advantage of both facts.

Boston Convention Committee
Manson Glover,
General Chairman

*Philadelphians smile. Editor.

THREE-WAY SAVINGS with our Udylite AUTOMATIC PLATING EQUIPMENT



REPORTS WIRE-O CORPORATION
MAKERS OF MECHANICAL BINDINGS

- **SAVINGS IN RAW MATERIAL COST**
- **SAVINGS IN PRODUCTION COST**
- **SAVINGS IN HANDLING COST**

Prior to installation of their Udylite Full Automatic Plating Machine, Wire-O Corporation made loose leaf metal parts from expensive nickel-plate steel. Now, they produce these parts from raw steel and plate them after fabrication—eliminating buffing and polishing processes . . . and giving a much higher production rate with lower labor costs.

You, too, can streamline your plating operations. Install Udylite Full Automatic Plating Machines and capture new savings—new quality—new sales appeal for your products. Call in your Udylite Technical Man and let him show you how quickly and easily you can get added profit with Udylite equipment. Or write direct to *The Udylite Corporation, Detroit 11, Michigan*, there's no obligation.

PIONEER OF A BETTER WAY IN PLATING

Representatives in Principal Cities

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 387.

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GES

SING

Branch News

COMING EVENTS

DETROIT BRANCH

ANNUAL STAG DAY
Saturday, July 29
at Forest Lake Country Club
near Pontiac, Mich.

Chairman: Walter Pinner
Program: Soon to be announced
Make plans now to attend.

F. J. NEWTON, *Librarian*

INDIANAPOLIS BRANCH

ANNUAL EDUCATIONAL SESSION
AND DINNER DANCE
Saturday, May 6
in Indianapolis Athletic Club

Educational Session

Papers on "Rectifiers vs. Motor Generators", "High Chloride Nickel Baths", and others

Dinner-Dance
Floor Show

Tickets from Robert Bruck, 849 Massachusetts Avenue, Indianapolis, Ind.

D. L. PATRICK,
Publicity Chairman

11TH ANNUAL NEW ENGLAND REGIONAL MEETING

Saturday, May 6
in the Hartford Club, Hartford, Conn.

Educational Session at 2:30 P. M.
Banquet in the Evening

Entertainment—Dancing

Tickets from Stanley Platoz, 26 Erwin Place, New Britain, Conn.

TORONTO BRANCH

ANNUAL REGIONAL MEETING
Saturday, May 6
in General Brock Hotel, Niagara Falls, Ontario

Technical Session in the afternoon

Speakers: Mr. Ed Rinker, Bart-Messing Corporation, Brooklyn, N. Y., "Cleaners"
Mr. Harold W. Faint, Industrial Filter and Pump Manufacturing Company, Kalamazoo, Mich., "Filtration"
Mr. W. M. Phillips, General Motors Research Laboratories, "Plating on Zinc Base Diecastings"

Dinner-Dance in the Evening

Tickets at registration desk in hotel

R. W. STEPHENS, *Secretary*

BALTIMORE-WASHINGTON BRANCH

A regular monthly meeting was held on March 14 at the National Bureau of Standards, Washington, D. C. After a brief business session, LIBRARIAN WALTER OLSON introduced the speakers of the evening, MR. T. R. BOGGESS, a fellow Branch member who is Superintendent of the plating shop of the Norfolk and Western Railway at Roanoke, Va., and MR. L. E. GAUCHER, Assistant Chemist of the same company. Mr. Gaucher gave general information and showed interesting pictures of the N. and W. Railway. Mr. Boggess then described in some detail the many interesting applications of plating to railway parts and equipment. It was evident that the Norfolk and Western operates a large progressive plating shop and that savings to the company, e. g., from increased wear resistance of heavily chromium plated parts, amply justifies this policy. An interesting discussion followed the talks. The Research Committee's strip film, "The Wife of Lot", was shown.

VERNON A. LAMB, *Secretary*

BOSTON BRANCH

MR. WALTER PRINE of The International Nickel Company, New York City, was the speaker on February 2, having for his subject "Practical Nickel Plating". He discussed general operations, preparation of base metals including diecastings and aluminum alloys, plating solutions, purification, circulation, and temperature control were brought into the picture, as well as such headaches as stripping of nickel and nickel plus chromium. Samples were shown of nickel plating on various metals and plastics, and the International Nickel Booklet, "Practical Nickelplating", was distributed.

GEORGE P. SWIFT, *Secretary*

BOSTON BRANCH

Among the decisions made or announced at the meeting on March 2 were (1) to defer action on the invitation of the Hartford Branch for Boston to join the New England Annual Regional Meeting to the October meeting and (2) to hold the Branch's annual meeting on June 22.

MR. RICHARD FURBUSH, a member of the Massachusetts Senate and President of Adams Engineering Company, Newton, Mass., discussed "Plating Racks and Rack Design". He brought along not only sample racks but also sample parts to show just what the problems were. Various types of holders were shown, with and without special locking devices. Care of racks was brought in as well. The audience's attention was complete throughout the talk, which was enjoyed by all.

GEORGE P. SWIFT, *Secretary*

BRIDGEPORT BRANCH

One of the highlights at the regular monthly meeting on February 3 was a discussion of an apprenticeship program for the training of metal finishers by Mr. Harry Hyman of the Bureau of Apprenticeship, U. S. Department of Labor. He pointed out that instruction, furnished by the Department through its Office of Education, in the fundamentals of plating, polishing, and buffing could be arranged for day or night sessions or both, and recommended that the Branch get behind an early course.

Another highlight was a talk by MR. E. F. LANKES, Regional Manager of Detrex Corporation, Detroit, Mich., on "Vapor Degreasing". His illustrated presentation of operation and maintenance of a variety of equipment provoked considerable discussion. He was introduced by MR. W. A. ROSS, Detrex Connecticut representative.

Two new members and a new membership application were received and a foreign member given transfer to membership-at-large.

PRESIDENT CARL SCHAEFER appointed a committee, consisting of R. C. BARRETT, Chairman; C. T. TEMPLE, G. J. ECKHOLM, FLOYD TATUM, and A. J. CHENIS, to arrange the Branch's exhibit at Boston.

The thirty-five members and guests enjoyed refreshments served through the courtesy of MR. W. H. LINDSAY, JR., of The Chemical Corporation, Springfield, Mass.

JOSEPH G. STERLING,
Secretary-Treasurer

BRIDGEPORT BRANCH

The thirty-five members and guests who attended the Open Meeting and Educational Session on February 15 heard MR. RICHARD C. BARRETT, Consultant and a member of the Branch, describe "Effects of Addition Agents in Plating Baths".

Centering his discussion upon bright nickel plating, Mr. Barrett pointed out how brighteners affect the deposit structure to increase hardness and reduce ductility, that boric acid forms complex ions in the bath, and that the *p*H range for nonpitted deposits is often very narrow, requiring use of wetting agents or peroxide. He emphasized the necessity of keeping buffing and other dust out of the plating room, and discussed the value of baths which produce levelling. Considerable discussion followed.

JOSEPH G. STERLING,
Secretary-Treasurer

BUFFALO BRANCH

At the meeting on March 3 the speaker was MR. E. LANG of E. I. duPont de Nemours & Company, who presented a paper on "Diaphragms in Copper Plating Baths". This was essentially the same paper as presented at the Atlantic City Convention, with some additional data. The speaker seemed to offer a sound approach to the problem of roughness in copper baths.

A committee consisting of TONY NIGRO and BILL FATHERINGHAM was appointed to investigate the possibility of a visit to Talon, Inc., Meadville, Pa., to observe its waste-purification system.

H. A. FUDEMAN, *Secretary*

CHICAGO BRANCH

On March 10 forty members were present for dinner and 115 at the meeting which followed.

The speaker for the evening was MR. S. S. JOHNSON, A. E. S. Past President and Technical Director of the Electrolytic Department, Weirton Steel Company. The subject, "Electrolytic Tin Plate", was illustrated with sound color movies and most interesting.

The Nominating Committee presented a slate of officers for the year 1950–1951, which was unanimously elected:

President—DR. J. H. MONAWECK
First Vice-President—A. G. BARTMANN
Second Vice-President—CLEM PETROSIUS
Librarian—J. M. ANDRUS
Secretary-Treasurer—PAUL GLAB
Board of Managers—MARION LONGFIELD, Chairman; J. BOUDREAU, R. F. LEDFORD

Delegates were C. KELLY, J. ANDRUS, and P. GLAB, with G. GILBERTSON, M. LONGFIELD, and R. HAZUCHA as alternates.

R. F. LEDFORD, *Correspondent*

CINCINNATI BRANCH

The Branch met on March 22. Thirty members were present for dinner, and additional members joined the group later to hear a very instructive talk by MR. F. C. MESLE of Oneida, Ltd., on problems connected with "Silver Plating", as well as difficulties encountered in all types of plating. Mr. Mesle's many years of experience in metal finishing made him an ideal speaker on this subject, and he proved very helpful to the members during the question and answer period which followed.

The winning ticket in the election of officers for the coming year follows:

President—E. A. BLOUNT
Vice-President—FRED L. HINTZE
Librarian—ROBERT D. MILLER
Secretary—CHARLES WISE
Treasurer—CHARLES T. NUZUM

The Branch was sorry to learn that it was losing the services and pleasant personality of its Secretary, H. ROPER DAVIS, who is retiring from metal finishing to enter a new business. Mr. Davis did an admirable job during the past two years and departs from Cincinnati with a host of friends who wish him the best of luck in his new venture.

After the meeting the members relaxed for a social hour as the guests of The Buckeye Products Company.

CHARLES WISE, *Secretary*

CLEVELAND BRANCH

At the March 10 meeting, DR. RALPH A. SCHAEFER presented a talk on "Current Distribution", in which he dealt with the theoretical and practical aspects of current distribution in electroplating. He stated that the results of the work presently being carried on by A. E. S. Research in current distribution will be useful to the practical plater who does specification plating.

The date for the Cleveland Branch Annual Dinner-Dance was definitely set for April 15. JACK LITTLE is in charge of this affair and, after a late start, really has the ball rolling.

Newly elected officers are:

President—L. N. ELICKER
First Vice-President—HOWARD H. BLOUCH
Second Vice-President—J. D. LITTLE
Librarian—CURTIS G. MILLER
Secretary-Treasurer—

HARRY POCHAPSKY

HARRY POCHAPSKY,
Secretary-Treasurer

DAYTON BRANCH

The March meeting, designated as Founders Night, National Officers Night, and Old Timers Night, was held on March 17 in Suttmillers' Restaurant. The National Officers were represented by A. E. S. FIRST VICE-PRESIDENT WILLIAM J. NEILL and the Founders by CLARENCE VAN DERAU, ROBERT SUMAN, and A. L. LAMOUREUX. GEORGE LANTZ and W. TURNER rounded out the list of Old Timers.

A. E. S. First Vice-President W. J. Neill accepts the Dayton Award for Branch attendance at meetings from Branch President E. W. Rehme at the Dayton Branch Fifth Annual Meeting on February 25

Speakers J. B. Winters of R. O. Hull & Company, Cleveland, and H. M. McAleer of Formaz Manufacturing Company, Detroit, flanking meeting chairman, W. J. Neill

A dinner preceded the meeting, and thirty-one members and friends were present. Delegates to the Boston Convention were elected as follows: WALTER MOLINE, L. A. CRITCHFIELD, and FRED BAUCH, with ROBERT SUMAN, WARREN ROBINSON, and ROBERT RULEFF as alternates.

Honorary membership in the Branch was conferred on Messrs. Van Derau and Suman.

Interesting talks by Mr. Van Derau and Mr. Neill about the olden days in the American Electroplaters' Society were followed by an informal discussion of past experiences in the electroplating field.

The program was a great success, and all present enjoyed it immensely.

R. M. CLINEHENS, *Secretary*

HAMILTON BRANCH

On March 17, in the absence of PRESIDENT W. YOUNG, VICE-PRESIDENT E. CRANFIELD introduced the guest speaker, MR. W. PRINE of The International Nickel Company, New York City.

In his address on the subject "Nickel Plating Today", Mr. Prine outlined the latest applications for nickel plating and described in detail the various nickel bath compositions in use today. Deposition of nickel coatings on plastic became prominent during the recent war. Hard nickel coatings play a very important part in many chemical industries, such as caustic and petroleum. Extensive use of heavy nickel deposits is found in salvage of paper rolls and shafts where thick deposits are required for rebuilding worn parts.

The advantages and disadvantages of each solution was given, together with the best operating conditions as well as the troubles that arise in nickel plating and their causes.

A lively discussion period followed.

MR. R. LAW of The International Nickel Company, Toronto, spoke for a few minutes and requested contributions of industrial interest for the new INCO publication, "Nickel Plating".

G. M. DALTON, *Correspondent*

HARTFORD BRANCH

The meeting on March 20 was attended by about ninety members and guests.

After a movie, "Golden Horizons", had been shown through the courtesy of the Ampco Metal Company and MR. GEORGE B. HOGABOOM had reported the "Latest Developments in the Finishing Industry", DR. WALTER R. MEYER, President of Enthone, Inc., New Haven, Conn., presented a paper on "Pickling and Bright Dipping of Metals".

Dr. Meyer described the advantages and disadvantages of such pickling acids as sulfuric, hydrochloric, hydrofluoric, and phosphoric when used hot or cold. He then discussed the use of inhibitors to prevent or to control fumes, spattering, and hydrogen embrittlement and of surface active agents to lower the dragout losses. The bright dipping of copper and its alloys, zinc, cadmium, silver, aluminum, and nickel was treated in detail. The following is common to all or most

all bright dips: the reaction velocity, or the rate of attack on the metal should be high to obtain leveling action, an oxidizing agent must be present, and a film (visible or invisible) should form on the metal.

KERMIT T. SIMONS acted as technical chairman, and refreshments were served through the courtesy of Enthone, Inc.

STANLEY PLATOZ, *Secretary*

JACKSON-LANSING BRANCH

Frederic B. Stevens, Inc., was host to the Branch at the meeting on March 14 at the Meadow Lark Inn.

After forty-seven members present had enjoyed a Frankenmuth-style chicken dinner, MR. J. H. KIRKPATRICK of the Stevens Company gave a very interesting talk about the latest progress in "Disposal of Plating Room Wastes". This is a serious problem which the Society has been working with various conservation departments.

PRESIDENT L. M. HENDERSON and two others whose names will be announced later will attend the Boston Convention as Delegates.

A sound movie, "Wyoming", was shown at the end of the meeting.

FRED W. STUCKENBERG,
Publicity Chairman

LANCASTER BRANCH

The regular March meeting was held in the Research Laboratories of the Aircraft Marine Products Company, Harrisburg, Pa.

The speaker was our own HARVEY REYNOLDS, foreman plater of C. E. Snyder & Son. He drew on his own experience to give a short discourse on some of the tricks and practices in nickel, copper, cadmium, and zinc plating.

After reports by the Nominating, Exhibit, and Law Committees, a lunch, including baked beans and ham, was served by courtesy of MR. and MRS. CHARLES SNYDER. C. W. SMITH, *Secretary*

LOS ANGELES BRANCH

The regular March dinner meeting held at Rodger Young Auditorium on March 8 had an attendance of forty members.

After one new member and one application for membership had been received, PETER ROGERS reported on the status of preparations for the Annual Educational Session and Dinner Dance. An excellent array of speakers for the educational session had been arranged.

The election of officers gave the following results:

President—R. J. WOOLEY
First Vice-President—ROY LOSTUTTER
Second Vice-President—M. H. ORBAUGH
Secretary—G. D. MCDONALD, JR.
Librarian—MORTON SCHWARZ
Treasurer—ERNEST FEST
Board of Managers—DON BEDWELL, Chairman; ALAN SILZINGER, WALTER BEHLENDORF.

Delegates to the Boston Convention were M. H. ORBAUGH, R. J. WOOLEY, and DON BEDWELL; alternates JOHN HUNTER, PETER ROGERS, and MORTON SCHWARZ.

Three Bureau of Mines films were shown on the Mining, Smelting and Milling of Zinc, Tin and Nickel.

M. H. ORBAUGH, *Secretary*

LOUISVILLE BRANCH

The regular monthly meeting on March 16 opened with a business session, at which GERHARD HILLEBRAND, JR., ALBERT STEIDLE, and STANLEY BEYER were appointed to a Nominating Committee for next month's election of officers, and ARTHUR OERTEL, STANLEY BEYER, and H. D. JONES wer elected Delegates and JOHN SCHOLL and TOM ALLISON alternates to the Boston Convention.

To uphold the Branch record since its inception of having outstanding guest speakers at every meeting, TOM ALLISON introduced MR. WILLIAM D. GORDON, technical representative of MacDermid, Inc. Mr. Gordon presented samples of the MacDermid "Mirror-Brite" copper plating chemicals and compared this bath with the conventional cyanide and Rochelle salt solutions in general use. Many interesting examples of the application of bright copper plating were exhibited and discussed.

STANLEY J. BEYER,
Secretary-Treasurer

MELBOURNE BRANCH

Forty-one members and visitors were present at the 50th regular meeting of the Branch on March 16. After a short Question Box session, COMMITTEEMAN GLEN WALKER outlined plans for sending the Branch Secretary to this year's Annual Convention in America.

PETER TIKOTIN then introduced MR. D. ASHBY, Rectifier Engineer for Westinghouse Brake and Signal Company, England, who spoke of "Rectifiers and Constant Current Density Plating". With the aid of lantern slides, the speaker described the building of the first rectifiers in England. He then traced the development of the modern compact, efficient rectifiers from the bulky, less efficient early models. Details were given of the circuits used in appliances for a constant-current-density plating on loads of varying area. This latter subject led to a very long and interesting discussion.

JOHN J. DALE, *Honorary Secretary*

MONTREAL BRANCH

MR. W. M. PHILLIPS, Head of the Electrochemistry Department of General Motors Research Laboratories, gave an illustrated talk on "The Application of Instruments to Electroplating", at the regular monthly meeting on March 7. Twenty-seven members and guests were present when LIBRARIAN P. M. COADY introduced the speaker.

Among instruments described for testing the plate were salt-spray equipment, devices for measuring stress in electrodeposits, and the hardness gauge. Among those used as aids in plating were temperature controllers, proportioners for adding plating salts, and automatic *p*H recorders. Several of these instruments require too great an initial expenditure for use in the small plating shop.

The following officers were elected at the business session:

President—P. M. COADY
First Vice-President—J. G. CARRIQUE
Second Vice-President—J. J. ROCHE
Third Vice-President—R. E. GORDON
Secretary-Treasurer—W. L. GLOVER
Librarian—PAUL JACQUES
Board of Managers—O. MOLDENSCHART, G. MORRISSETTE, J. H. CHARLES, J. P. COURTEMANCHE, G. R. KING.

The new slate of officers was installed by J. D. FAIRBAIRN. PRESIDENT P. M. COADY then presented Mr. Fairbairn with the Branch Past-President's silver lapel pin.

GEORGE R. KING, *Secretary-Treasurer*

NEWARK BRANCH

Forty-five members and guests attended the regular meeting on February 3.

During a short business session, one applicant was elected to membership, one new application was received and two members were suspended for nonpayment of dues.

PRESIDENT BOWERMAN requested that members who no longer care to keep their old copies of THE MONTHLY REVIEW or the Convention *Proceedings* bring them in so that sets of these publications may be completed at various large libraries throughout the country.

DR. D. GARDNER FOULKE, Exhibit Chairman, gave a short talk to arouse interest in developing ideas for the exhibit of electroplated ware at the forthcoming Convention.

LIBRARIAN ROBERT EHRHARDT introduced MR. R. J. PECK, District Manager of Electric Products Company, who spoke about "Rectifiers and Generators for Electrolytic Power Supply". When rectifiers were first put on the market, there were many misapplications. The greatest use of rectifiers came during World War II. Mr. Peck used lantern slides to illustrate the construction features of the rectifier and generator put out by his company and then showed the advantages and disadvantages of each type. Questions about maintenance and repair were asked at the conclusion of the fine presentation. SAMUEL S. FREY,
Recording Secretary

NEWARK BRANCH

Forty members and guests attended the meeting on February 17.

A contribution of $25.00 was voted as the Branch's share in this year's Red

McGEAN

NICKEL SULPHATE

Ideal for Nickel Plating

- EASY TO HANDLE
- HIGH IN PURITY
- FREE FLOWING
- DISSOLVES READILY

AVAILABLE FOR
IMMEDIATE DELIVERY
PACKED IN 100 LB. BAGS

The McGEAN CHEMICAL COMPANY
REPUBLIC BUILDING CLEVELAND 15, OHIO

Branch News

Cross campaign, one applicant was elected to membership, and Dr. D. Gardner Foulke, Chairman of the Branch Exhibits Committee, reported that a central point of interest, control of current distribution, had been adopted around which the exhibit will be built.

A team of speakers from the Pangborn Manufacturing Company were introduced by Librarian Robert Ehrhardt to discuss "Abrasive Blasting".

Mr. A. L. Gardner, Advertising Manager, began with a history of blast cleaning and illustrated his points by means of chalk artistry. The principle of this type of cleaning is to direct onto the surface to be cleaned a high-velocity stream of air or liquid containing abrasive materials. To keep the operator from suffering from the polluted air, a housing is erected around the equipment. Abrasives found suitable are steel shot and such siliceous materials as sand and diatomaceous earth. Power to drive the abrasives comes from fast-moving air, water, or inhibited solutions. Mr. B. S. Marks, Manager of the Hydro Finish Division, continued with details of the Hydro Finish procedure. To help the audience visualize the set-up, lantern slides were used. A novel decorative finish in bright nickel-chromium was shown, in which a spiral masking tape allowed portions of the surface to be blasted while protecting the rest.

A discussion period ensued in which the audience propounded dozens of questions, which kept all of the speakers busy for about an hour.

Samuel S. Frey,
Recording Secretary

PHILADELPHIA BRANCH

A joint meeting with the Philadelphia Chapter of The Electrochemical Society was held on March 1 in the Harrison Laboratory, University of Pennsylvania. It was preceded by a dinner at the nearby Lido Restaurant.

Branch President Dr. Samuel Heiman opened the meeting, and both he and Dr. Arthur Osol, Chairman of the Philadelphia Chapter of The Electrochemical Society, gave brief descriptions of their respective Societies and their activities.

Dr. Osol introduced the speaker of the meeting, Dr. Alfred L. Ferguson, Head of the Electrochemistry Department, University of Michigan, a prominent member of the A. E. S. and President of the Electrochemical Society, whose topic was "Polarization and Overvoltage—Basic Principles, Definitions, and Important Applications".

Dr. Ferguson based his talk on a series of slides and distributed the titles of the slides to his listeners. His presentation covered basic unsolved problems in electrochemistry; some known facts about overvoltage; a more detailed consideration of the influence of temperature, complex-ion formation, current density, and agitation on overvoltage; some basic concepts and definitions; and overvoltage measurements by the commutator method. It was regretted that time did not permit Dr. Ferguson to complete his extremely interesting and informative talk, which, although directed at men with training in the theoretical electrochemistry, nonetheless was not above the heads of platers.

Nominations for officers for the 1950–1951 fiscal year were then received.

President Heiman spoke on the possibility of the Branch sponsoring a course in electroplating at Temple University. Following a discussion it was agreed that a questionnaire be sent with the next "Reminder" to obtain additional opinions.

One new active member was admitted. Attendance was eighty.

I. Wm. Marcovitch, *Secretary*

PITTSBURGH BRANCH

The meeting on March 9 began with the election of two new members. Librarian Dr. L. E. Lancy announced that the May meeting would be held jointly with the Pittsburgh Section of The Electrochemical Society.

The Chairman of the Annual Banquet Committee, John Davidson, assisted by several of his committee members, reported in poetry on the coming event for which plans are now complete. Mr. Davidson was then appointed "Poet Laureate" of the Branch.

Election of officers for 1950–1951 resulted in the following:

President—Edwin J. Smith
First Vice-President—R. J. Goldbach
Second Vice-President—R. A. Woofter
Secretary—John Davidson
Treasurer—R. H. Schindler
Librarian—E. B. Washburn
Board of Managers—L. J. Schmitt, Sr.

Delegates are S. S. Johnston, F. R. Keller and W. J. Hennessy, with L. E. Lancy, L. J. Schmitt and R. A. Woofter, alternates.

W. J. Hennessy and J. P. Coros remain on the Board of Managers.

The Librarian then introduced Mr. C. H. Castle, Technical Director of the Roto-Finish Company of Kalamazoo, Mich., who described the process developed in the Roto-Finish laboratories for grinding, deburring, polishing, brightening, and coloring various types of manufactured parts. Mr. Castle pointed out that the process reduces finishing to very simple procedures which a semi-skilled employee can handle and results in a saving of time, elimination of dust controls, and reduction of cost. Specially designed units, compounds, and grinding media are required to carry out the operation. It has many applications, especially on small parts which are usually difficult to handle by other means. Two reels of colored movies were used to illustrate the talk, and several finished parts were exhibited.

After an interesting discussion period the meeting was adjourned.

E. J. Smith, *Secretary*

PROVIDENCE-ATTLEBORO BRANCH

The extremely cold weather and threatening heavy snowstorm on February 20 cut the regular attendance in half.

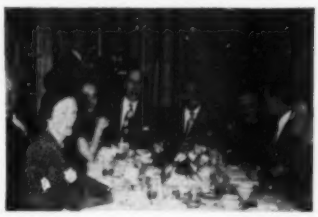
Mr. Frank Eddy, Superintendent of Finishing at Chase Brass & Copper Company, Waterbury, Conn., spoke about "Pickling and Bright Dipping of Copper and Its Alloys". In general, the solutions used in mass production were much weaker than those employed in the jewelry industry. The bright-dip finish required on industrial items would be rated very low by the operators of bright dips in the jewelry field. However, it is not the difference in solutions but the more careful attention to small details which is responsible for the greater brightness that is produced by jewelry bright dippers.

A nominating committee consisting of Messrs. Lonsbury, Clarner and Moore was elected and instructed to bring in a slate of officers for the March meeting.

Edward A. Parker, *President*

SAGINAW VALLEY BRANCH

The first "Ladies' Night" Dinner-Dance was held in the Colonial Room of Zehnder's Hotel in Frankenmuth, Mich., on Wednesday, February 8.



The dinner at 7:30 P. M. was attended by one hundred and fifteen members and their guests, who enjoyed a very nice dinner, accompanied by music by a piano-accordion player. The dining room was decorated with large hearts, and each lady was given a lovely novelty China cup-and-saucer set as a gift. Dancing followed the dinner.

The committee, composed of Joe Farmer, W. K. Kaufmann, L. D. Faulman and Russell Smith, did much to make the first "Ladies' Night" a success.

John W. Lee,
Recording Secretary

ST. JOSEPH VALLEY BRANCH

Twenty-three members and guests enjoyed the chicken dinner, and thirty-two were present for the technical session on February 1.

After Second Vice-President Victor Peterson had presented a membership report, First Vice-President Dr. Har-

OLD WIESNER, Branch Research Chairman, reported that two new sustaining members had been signed: The Bendix Aviation Corporation and the Studebaker Corporation. This makes three sustaining members in the St. Joseph Valley area.

JIM HEDGES, Chairman of the Nominating Committee, reported the following nominations for 1950–1951:

President—DR. HAROLD J. WIESNER
First Vice-President—VICTOR E. PETERSON
Second Vice-President—RICHARD C. LOCKERBIE
Librarian—DR. ERNEST J. WILHELM
Secretary-Treasurer—EUGENE ROTH
Board of Managers—JOHN C. BAYMAN (1 year), WILLIAM S. McDOWELL (2 years), ELMER O. BRADY (3 years)

The election will be held at the March 1st meeting, because the April Meeting will be a joint affair with the A.S.M. at the University of Notre Dame.

One application for membership was announced.

The speaker for the evening was MR. WILLIAM H. WEBB of The Detrex Corporation. In connection with his talk about "Solvent Degreasers", a series of three talking films were shown, "The Design of Degreasers", "Operation of Degreasers", and "Maintenance of Degreasers".

Mr. Webb answered many questions from the members present. After the regular technical session and between film changes, several comic shorts were shown to the delight of all present.

EUGENE ROTH, *Secretary-Treasurer*

ST. LOUIS BRANCH

The meeting on March 8 was opened by VICE-PRESIDENT VOGT. Twenty-eight members attended the dinner, and thirty-eight were on hand for the meeting.

At the suggestion of the Board of Managers the appointment of a nominating committee was held open till next month.

Mr. Vogt introduced MR. A. H. DUROSE of the Harshaw Chemical Company, Cleveland, Ohio, who gave a very interesting and instructive talk on "Nickel Plating and Polishing".

EDWARD HUNLETH, *Secretary*

SAN FRANCISCO BRANCH

A dinner meeting on March 16 in El Curtola Restaurant had an attendance of forty-one members and guests.

CHAIRMAN OWENS of the Nominating Committee presented its slate for election to office for 1950–1951:

President—R. W. KARCZYNSKI
First Vice-President—GEORGE COOK
Second Vice-President—JOHN MEEHAN
Secretary-Librarian—ROY FALLOM, JR.
Board of Managers—FRED DARTT, FRED HUNTINGTON, J. R. PATTENGER

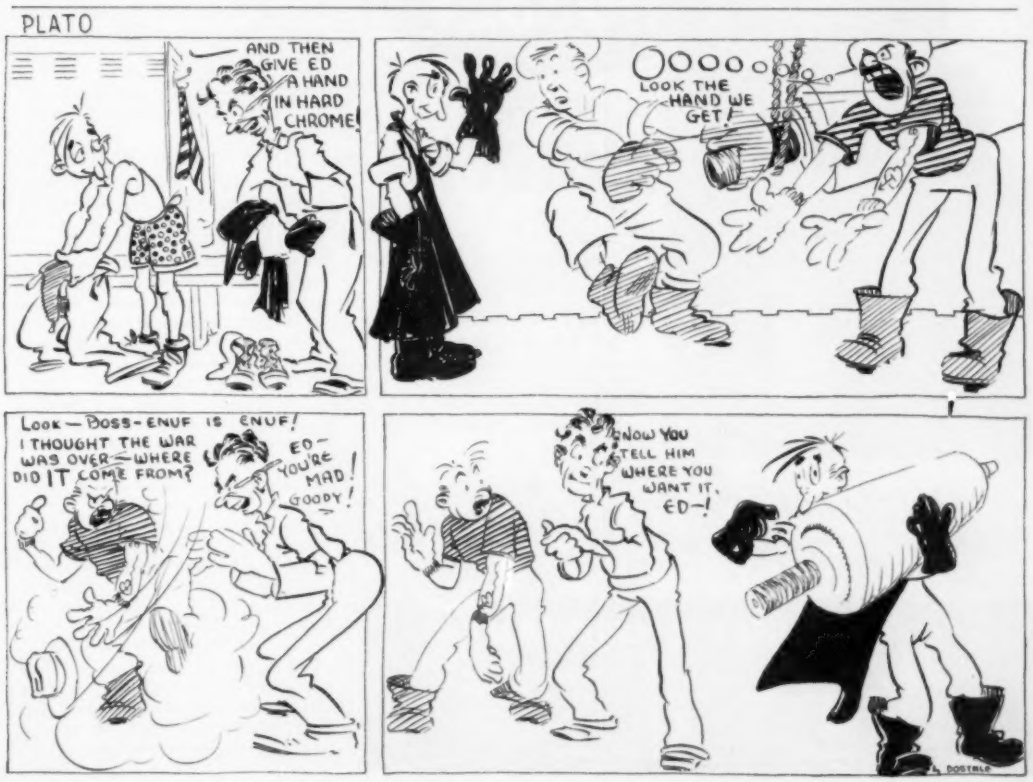
After SAM HERRICK had related some of the past history of the Branch and three applicants had been voted into membership, PRESIDENT F. R. DARTT introduced the guest speaker, A. E. S. PRESIDENT A. W. LOGOZZO. His topic, "Bright Nickel and Chromium Plating", was illustrated with slides and motion pictures. At the conclusion, Mr. LOGOZZO was asked many questions.

JOHN J. MEEHAN, *Secretary*

SOUTHEASTERN BRANCH

The meeting on February 3 in Cleveland Hotel, Spartonsburg, S. C., with its good attendance of thirty-three members and guests and its excellent program, proved one of the best in the Branch's history. Atlanta was represented by ten members. PAST PRESIDENT R. E. NORMAN came from Birmingham, Ala., and GEORGE N. NAYLOR from Jacksonville, Fla., and among the guests were none other than our good friend, A. E. S. PAST PRESIDENT F. FULFORTH of United Chromium, Inc.

After a good steak supper in the Hotel's Club Room and a business session at which two new members were elected, CLEM HOHNER introduced the speaker, DR. WALTER R. MEYER of Enthone, Inc. He


PLATO
AND THEN GIVE ED A HAND IN HARD CHROME!
OOOOOOO LOOK THE HAND WE GET!
LOOK — BOSS - ENUF IS ENUF! I THOUGHT THE WAR WAS OVER — WHERE DID IT COME FROM?
ED — YOU'RE MAD! GOODY!
NOW YOU TELL HIM WHERE YOU WANT IT, ED —!

delivered a most interesting and highly informative address about "Problems in Electroplating". A lively discussion period ensued, after which many retired to a hotel room for refreshments and a bull session.

Special thanks were given to First Vice-President E. J. Slemons for making this first visit to Spartonsburg such a success. We hope that the March meeting in Jacksonville, Fla., will be equally good.

William T. Weymouth,
Secretary-Treasurer

SYDNEY BRANCH

The December meeting took the form of an Annual "Smoko". Due to some excellent entertainers and the prevailing Christmas spirit, a most enjoyable time was had by all.

The sixtieth general meeting took place on February 16 in the Trust Building, Sydney.

After the general business had been dealt with, W. Paterson delivered a short presidential address and followed it with an interesting talk on his experiences with cobalt bright-nickel baths. Discussion then became so earnest that the meeting continued for three hours, truly a sign of a successful meeting.

H. Coates, *Secretary*

SYRACUSE BRANCH

Delegates and alternates to the 1950 Convention at Boston were elected at the regular monthly meeting on March 20.

The nomination committee submitted a slate of officers for the approval of the Branch members, and several communications were read for the edification of the members.

Attendance was sixteen.

K. S. Parnell, *Secretary-Treasurer*

TOLEDO BRANCH

On February 2, forty members heard Mayor Michael Di Salle of Toledo, introduced by B. Gommersall, tell about conditions in Europe as he had seen them during his trip last summer. Mr. Di-Salle proved very informative and interesting and received congratulations by many members following his address.

Refreshments were served after the meeting through the courtesy of Mr. G. H. Henshaw of the Marco Products Company.

G. H. Bergeman, *Secretary*

WATERBURY BRANCH

The January meeting featured Mr. Walter Pinner whose subject was "The Perflow Nickel Plating Process". This is the eighth successive year that Mr. Pinner has spoken before the Branch, each time discussing a different phase of electroplating.

While the perflow solution does not provide what could be termed a bright nickel, it does fill in the imperfections in the basis metal and, as the thickness of the deposit increases, smooths the surface with a coating that buffs with ease to a high color and is ductile enough so that items such as bumpers may be sprung into place without cracking or distortion of the plate. In order to obtain all the advantages of this type of bath, careful control and an understanding of the effects of impurities is of utmost importance. Mr. Pinner detailed his experience with this type of bath, showing the effects of impurities and how best to handle the solution for maximum results.

S. L. Henn, *Secretary*

WATERBURY BRANCH

In February, Dr. George Dubpernell gave perhaps the most important of several recent book reviews. *Chrome Dur*, an annual publication issued by Centre d' Information du Chrome Dur, a French organization to gather available information on hard chromium plating, contains an excellent collection of papers on this subject with a very complete bibliography and abstracts from about one hundred and fifty papers.

Emil Shaker, covering new developments, reviewed patents on the recovery of chromic acid by ion exchange resins, addition agents for zinc cyanide baths, and elimination of patchiness in porous chromium (by Dr. Dubpernell).

Coming at a time when our New England roads were very slippery, Mr. W. M. Phillips of General Motors Corporation appropriately dealt with the anti-skid properties of rubber used in tires. His talk, "Development in Cold Rubber—Its Use in Tire Manufacture and Improvements in Anti-Skid Characteristics", considered the properties of various types of rubber. An elaborate setup of small cars tired with several different rubbers graphically illustrated their behavior.

S. L. Henn, *Secretary*

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Membership Report of the A. E. S.

Elections

BRIDGEPORT BRANCH: Ralph H. Sherman

BUFFALO BRANCH: Robert M. Burford, Jr., William H. Sutton

CHICAGO BRANCH: R. J. Becker, Kenneth Birdwell, L. V. Brown, Ray Dearth, Earl M. De Loof, Harry F. Gardins, Marvin B. Lieberman, Julius Reader, Oliver J. Smith, Jens M. Westergaard

CLEVELAND BRANCH: Betty Lee Berden, Paul Kovacs

DETROIT BRANCH: C. O. Birkhold, King Brown, J. H. Eagle, R. M. Errington, D. F. Forbes, G. V. Kingsley, J. J. Linden, G. Magurean, J. B. Rohrer, E. M. Smith, S. B. Twiss, B. F. Walker

LANCASTER BRANCH: Quentin S. Stump

LOS ANGELES BRANCH: Donald A. Van Zile

MELBOURNE BRANCH: C. Cotton, L. J. Houghton, G. S. Smart, R. J. Smith, W. L. Speakman, D. A. Symes, F. S Ward

NEW YORK BRANCH: John P. Cordone, Victor Crescas, George J. D'Aiello, Sidney Gewertz, John L. Hain, Jack Malool, Joseph S. Russo, Simon Silverman, Walter A. Stadtler

PHILADELPHIA BRANCH: Richard B. Blass

PITTSBURGH BRANCH: William E. Dickman, Orville M. Null

ST. JOSEPH VALLEY BRANCH: Charles B. Sigler

SAN FRANCISCO BRANCH: Ronald H. Gordon, Roy Fellom, Jr., Billy J. Sullivan

SOUTHEASTERN BRANCH: Carl M. Cartledge, Reginald D. Norman, Herbert L. Padgett

SPRINGFIELD BRANCH: Ralph L. Barker, Roger B. Heroux

SYDNEY BRANCH: Charles K. Chapple, Herbert C. Bowra, George W. Olson

SYRACUSE BRANCH: Edward B. Psyck

WATERBURY BRANCH: Eric Lane

Reinstatements

BUFFALO BRANCH: P. J. Conn

CHICAGO BRANCH: Lawrence C. Mertz, Alfred K. Nelson, Ambrose L. Pietrowicz

DETROIT BRANCH: B. D. Thomas

SPRINGFIELD BRANCH: John H. Weir, Jr.

MEMBERSHIP-AT-LARGE: Joseph Coulthard

Transfers

I. A. Lee from Bridgeport Branch; John

Membership Competition

BRANCH	Membership April 1, 1949*	New Members	Net Change in Membership	Per Cent Net Change
FIRST GROUP				
DETROIT	427	97	+76	+17.8
NEW YORK	265	41	+18½	+ 7.0
HARTFORD	133	13	+ 7	+ 5.3
CLEVELAND	186	23	+ 8½	+ 4.6
PITTSBURGH	135	28	+ 6	+ 4.4
PHILADELPHIA	187	18	+ 4	+ 2.1
GRAND RAPIDS†	160	..	.....	.....
BRIDGEPORT	160	9	− 1½	− 2.1
CHICAGO	391	41	−11½	− 3.0
LOS ANGELES	217	19	−11	− 5.1
MILWAUKEE	132	15	− 7½	− 5.7
NEWARK	256	22	−15	− 5.9
BOSTON	153	10	− 9½	− 6.2
TORONTO	154	10	−25½	−16.5
SECOND GROUP				
MELBOURNE	81	41	+30	+37.0
CINCINNATI	90	15	+13½	+15.0
WATERBURY	122	8	+ 3½	+ 2.9
SYDNEY†	108	11	+ 3	+ 2.8
SYRACUSE	83	8	+ 2	+ 2.4
PROV.-ATTLEBORO	109	5	+ 2	+ 1.8
BALTIMORE-WASH.	83	8	.....	.....
DAYTON	98	5	− 3½	− 3.6
NEW HAVEN	108	3	− 4½	− 4.2
BUFFALO	82	8	− 4½	− 5.5
ST. LOUIS	107	14	−10	− 9.3
INDIANAPOLIS	104	11	−10	− 9.6
ROCHESTER	125	..	−20½	−16.4
ST. JOSEPH VALLEY	80	6	−14	−17.5
THIRD GROUP				
SOUTHEASTERN	38	21	+15½	+40.8
COLUMBUS	38	14	+ 9½	+25.0
LOUISVILLE	20	6	+ 4½	+22.5
ROCKFORD	56	8	+ 8	+14.3
LANCASTER	59	6	+ 3	+ 5.1
SPRINGFIELD	50	4	+ 1	+ 2.0
JACKSON-LANSING	59	5	− 1½	− 2.5
MONTREAL	69	10	− 2	− 2.9
SAGINAW VALLEY†	67	6	− 3	− 4.5
SAN FRANCISCO	71	22	− 5	− 7.0
TWIN CITY	77	7	− 6	− 7.8
ADELAIDE	76	4	− 8	−10.5
TOLEDO	56	2	− 6½	−11.6
ALLENTOWN-READING	43	2	− 9½	−22.1
OUTSIDE COMPETITION				
HAMILTON	...	17	+23	.....
WESTERN ONTARIO	...	19	+23	.....
AT LARGE	100	26	+ 6	.....
IN TRANSFER	22	..	+ 3	.....
TOTAL A. E. S.	5,237	666	+59	+ 1.1

Active Membership, April 1, 1950 5,296

*Subject to Correction. †Winners of membership competition in 1948–1949.

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Membership Report

B. Hitchcock from Buffalo Branch; K. K. Carpenter from Buffalo Branch to Pittsburgh Branch; I. M. Weiss to Cleveland Branch; James T. Parker from Indianapolis Branch; Hans Gernes from Indianapolis Branch; William Geissman from Milwaukee Branch; Henry Haas from New York Branch; George E. Vibberts, Jr., from New York Branch; Dwight Overcash from Syracuse Branch.

Resignations

BOSTON BRANCH: Harvey J. Gokey
MELBOURNE BRANCH: D. Glanvill
NEW YORK BRANCH: Carl T. Mason
PITTSBURGH BRANCH: J. M. Blazier, Harry L. Flister, Byron V. McBride
ST. JOSEPH VALLEY BRANCH: Frederich H. Craven
SPRINGFIELD BRANCH: Ernest Sagar
SYDNEY BRANCH: J. L. Lawler
MEMBERSHIP-AT-LARGE: Max K. Kennedy

Suspensions

BUFFALO BRANCH: H. H. Geils, C. Haeberle, M. J. Kibler, M. E. Kilroy W. Karski, G. Merz, G. E. Richards, L. Sones, D. E. Wellman, J. D. Tinsley, H. Woods, G. Zurenda
CHICAGO BRANCH: E. F. Becvar, E. L. Ingram, R. H. Jacoby, J. B. Niles, M. E. Pelletier, R. R. Ruenzel, J. M. Schlosser, H. O. Whamond
INDIANAPOLIS BRANCH: R. G. Weldele, Frank A. Hamp, Herbert Adams, Charles O. Harkin, Merrill Beyer, C. A. Swinehart, D. A. Cotton, George F. Young, F. W. Whipple
NEW YORK BRANCH: Sebastian J. Carbone, Jack Carton, Joseph DiZefalo, Harvey S. Levine, Edmund Pagington, Bernard H. Planner, Salvatore Romeo, Everett Stone, Joseph Varga, Vincent L. Wilker, Fred C. Wagner, Jr.
PITTSBURGH BRANCH: Joseph L. Wray
SPRINGFIELD BRANCH: Nicholas Hetman, John M. Johnston, Edward F. Lavelle
TORONTO BRANCH: Roy Bast, H. Brock, L. Gooden, R. Hale, E. C. Hiller, J. H. Johnson, G. B. Marsh, E. Moss, C. York

Deaths

BALTIMORE-WASHINGTON BRANCH: Matthew J. Kraft
BUFFALO BRANCH: H. Wood
CHICAGO BRANCH: Gus Jelinek, Robert H. Ruenzel
DETROIT BRANCH: L. C. Jones
MEMBERSHIP-AT-LARGE: L. G. Johnson

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Eastman Kodak Company, Rochester 4, N. Y.

Secretary.....The Executive Secretary

LOCAL BRANCHES

ADELAIDE, AUSTRALIA meets second Wednesday of each month. Address G.P.O. Box 598E, Adelaide, S. A., Australia.

ALLENTOWN-READING meets third Wednesday of each month in Spurgeon's Hotel, Allentown, Pa. Secretary-Treasurer, James F. Riegel, 425 S. 18th Street, Allentown, Pa. Research Finance Committee Chairman, G. W. Ward, 212 N. 6th Street, Allentown, Pa.

BALTIMORE-WASHINGTON meets second Tuesday of October, December, February, and April in Baltimore at the Engineers' Club, and of November, January, March, and May in Washington, D. C., at the Garden House, Dodge Hotel. Secretary, Vernon A. Lamb, National Bureau of Standards, Washington 25, D. C.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown, 72, Mass. Research Finance Committee Chairman, Eugene P. Carter, c/o United Carr Fastener Corporation, 81 Ames Street, Cambridge, Mass.

BRIDGEPORT meets first and third Friday of each month in Barnum Hotel. Secretary-Treasurer, Joseph G. Sterling, 134 Colony Street, Bridgeport 8, Conn. Research Finance Committee Chairman, Carl Schaefer, c/o Casco Products Corporation, 512 Hancock Avenue, Bridgeport 5, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary, H. A. Fudeman, 534 W. Ferry Street, Buffalo 13, N. Y. Research Finance Committee Chairman, B. P. Fortim, 200 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 8 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, Paul Glab, 882 N. Paulina Street, Chicago, Ill. Research Finance Committee Chairman, Clyde Kelly, 740 W. Englewood, Chicago 21, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary-Treasurer, Charles Wise, 3973 Ardmore Avenue, Cincinnati 16, Ohio.

CLEVELAND meets first Friday of each month in Cleveland Hotel at 8 P. M. Secretary-Treasurer, Harry Pochapsky, 24961 Euclid Avenue, Cleveland, Ohio. Research Finance Committee Chairman, E. C. Friedl, c/o du Pont Company, 1335 Guardian Building, Cleveland 14, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, Nathan L. Koslin, 2641 Cleveland Avenue, Columbus 11, Ohio.

DAYTON meets first Friday of each month in Engineers Club. Secretary, Richard M. Clinchens, 701 W. Stewart Street, Dayton 8, Ohio. Research Finance Committee Chairman, C. W. Powell, 3112 Princeton Drive, Dayton 6, Ohio.

DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, F. L. Clifton, 16536 Inverness, Detroit 21, Mich. Research Finance Committee Chairman, W. B. Knight, c/o Knight Plating Company, 3143 Bellevue Avenue, Detroit 11, Mich.

GRAND RAPIDS meets second Friday of each month at 7:30 P. M. in Rowe Hotel. Secretary, F. J. Darling, 3366 College Avenue, N. E., Grand Rapids, Mich. Research Finance Committee Chairman, John W. Putte, 308 Gladstone Avenue, S. E., Grand Rapids, Mich.

HAMILTON BRANCH. Secretary, William G. Finlay, c/o The M. & Y. Products Limited, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 Washington Street. Secretary, H. Smith, 335 Whittier Place, Indianapolis, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Hayes Hotel in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, E. F. Strelling, 1423 Kelsey Avenue, Lansing 10, Mich.

LANCASTER meets second Friday of each month at 8 P. M. in Thaddeus Stevens Industrial School. Secretary-Treasurer, Chester W. Smith, c/o Superior Metal Company, Bethlehem, Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway West, Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Scully's Restaurant. Secretary, G. D. McDonald, Jr., 3114 Purdue Avenue, Los Angeles 34, Calif.

LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Louisville. Secretary-Treasurer, Stanley J. Beyer, c/o Hart Products, 915 E. Kentucky Street, Louisville 4, Ky. Research Finance Committee Chairman, Garland Logsdon, 1519 Central Avenue, Louisville, Ky.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Hon. Secretary-Treasurer, John J. Dale, c/o Defense Research Laboratories, Maribyrnong, Victoria, Australia.

MILWAUKEE meets first Friday of each month in Red Arrow Club, 774 N. Broadway. Secretary-Treasurer, Harry J. Krueger, Route 7, Box 224, Wauwatosa 13, Wis. Research Finance Committee Chairman, James Paulson.

MONTREAL meets first Tuesday of each month in Mount Royal Hotel. Secretary-Treasurer, W. L. Glover, 754 Second Avenue, Verdun, P. Q., Canada. Research Finance Committee Chairman, P. M. Coady, c/o Alloycraft, Ltd., 27 Hillside Avenue, Westmount, Montreal 6, P. Q., Canada.

NEWARK meets first and third Friday of each month at 8 P. M. in Hotel Robert Treet. Secretary-Treasurer, George Wagner, 1130 S. Long Avenue, Hillside, N. J. Research Finance Committee Chairman, Edwin Bowerman, 166-41 17th Avenue, Whitestone, N. Y.

NEW HAVEN meets second Tuesday of each month alternating between Sterling Chemistry Laboratory, Yale University, and Hotel Taft. Secretary-Treasurer, B. J. Gaffney, 40 Filbert Street, Spring Glen, Hamden 14, Conn. Research Finance Committee Chairman, Dr. H. L. Kellner, c/o Lea Manufacturing Company, 16 Cherry Avenue, Waterbury 86, Conn.

NEW YORK meets second and fourth Fridays of each month in Statler Hotel. Secretary-Treasurer, George Schore, 150 Bennett Avenue, New York 33, N. Y. Research Finance Committee Chairman, George F. Hermann, 52 Chestnut Street, Brooklyn 8, N. Y.

PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, Al Hirsch, 1945 W. Airdrie Street, Philadelphia 40, Pa.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary, John M. Davidson, Iola Street, R. F. D., Glenshaw, Pa. Research Finance Committee Chairman, R. A. Woofter, 42 Hiland Avenue, Emsworth, Pittsburgh 2, Pa.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence-Biltmore Hotel. Secretary, Frank W. Boothroyd, 51 Barber Ave., Apponaug, R. I. Research Finance Committee Chairman, Pierre B. Lousbury, 78 North Ave., Attleboro, Mass.

ROCHESTER meets third Monday of each month in Ukranian-American Club. Secretary, Gordon W. MacDonald, North Bergen Road, R. D. No. 1, Bergen, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

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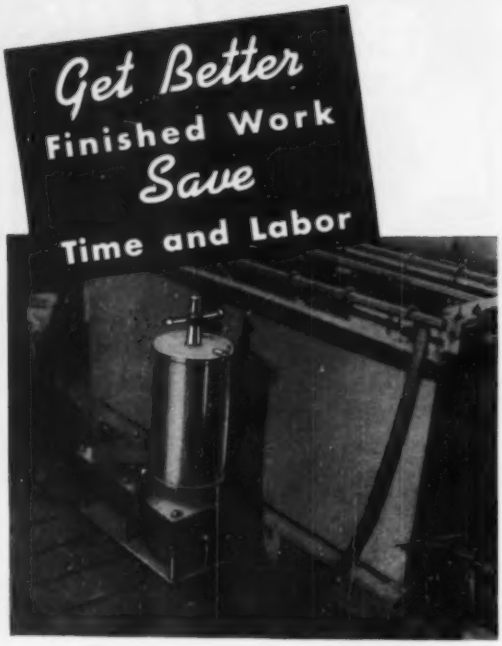

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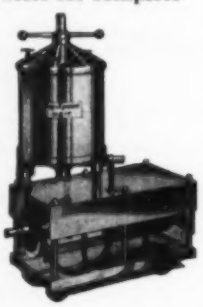

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ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 1720 Mishawaka Avenue, South Bend 15, Ind. Research Finance Committee Chairman, Ray Friend, 1435 Howard Street, Niles, Mich.

ST. LOUIS meets second Wednesday of each month in York Hotel. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, H. Siegel, c/o Siegel-Roberts Plating Company, 4193 Manchester Avenue, St. Louis, Mo.

SAN FRANCISCO meets second Thursday of each month, alternating between El Jardin Restaurant, 22 California Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, Roy Fellom, Jr., 709 Mission Street, San Francisco, Calif.

SOUTHEASTERN meets second Friday of each month in Robert Fulton Hotel, Atlanta, Ga. Secretary, William Weymouth, 173 Clay Street, S. E., Atlanta, Ga. Research Finance Committee Chairman, Dr. Fred W. Cox, Engineering Experiment Station, Georgia School of Technology, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Secretary, James Laing, 93 Woodbridge Street, South Hadley, Mass. Research Finance Committee Chairman, James Laing, c/o Van Valkenburg Company, Montgomery Street, Willamansett, Mass.

SYDNEY, AUSTRALIA. Secretary-Treasurer, H. Coates, Box 1339, G. P. O., Sydney, N. S. W., Australia.

SYRACUSE meets third Monday of each month in Hotel Syracuse. Secretary, Kenneth Parnell, c/o Brown-Lipe-Chapin Division, General Motors Corporation, Syracuse, N. Y. Research Finance Committee Chairman, George W. Cavanaugh, 129 Kenwood Avenue, Syracuse, N. Y.

TOLEDO meets first Thursday of each month at Commodore Perry Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio. Research Finance Committee Chairman, William Russell, 7th Street at Dixie Highway, Perrysburg, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, R. Stevens, c/o Bryden Brass Company, 927 Dufferin Street, Toronto, Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Canada.

TWIN CITY meets first Monday of each month, October through June, in Covered Wagon Cafe, Lodge Room, 114 S. 4th Street, Minneapolis. Secretary-Treasurer, Robert L. Buckley, 316 Builders Exchange, Minneapolis 2, Minn. Research Finance Committee Chairman, Gunnar Deedon, 3650 47th Avenue S., Minneapolis, Minn.

WATERBURY meets second Friday of each month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Dr. B, Cheshire, Conn. Research Finance Committee Chairman, Anthony Maz, c/o Risdon Manufacturing Company, Waterbury, Conn.

WESTERN ONTARIO meets third Friday of each month in William Pitt Hotel, Chatham, Ontario. Secretary-Treasurer, D. E. Paton, c/o Sydenham Trading Company, Ltd., Wallaceburg, Ontario, Canada.

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May 1, 1950

Dear Reader:

Speaking recently before the Purchasing Agents Association of Akron, C. H. Lang, Vice President and Manager of Sales of General Electric's Apparatus Department, pointed out that the purchasing agent's best friend is the modern salesman who is sincerely interested in his customer's welfare and expects to do business on a long-term basis.

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Tribute is often paid to the research man or the successful business manager. It is high time that the leg man of the industry be done homage for his often thankless job.

Sincerely,

Gustaf Soderberg

Future Meetings

New England Regional Meeting, A. E. S., sponsored by New Haven, Boston, Hartford, Springfield and Waterbury Branches in Hartford Club, Hartford, Conn., on May 6. Educational Session at 2:30 P. M., banquet in the evening.

Toronto Branch, A. E. S. Annual Regional Meeting in General Brock Hotel, Niagara Falls, Ont., on May 6. Technical session in the afternoon, banquet in the evening.

Indianapolis Branch, A. E. S. Annual Educational Session and Dinner-Dance in Indianapolis Athletic Club on May 6.

American Electroplaters' Society 37th Annual Convention and the 4th International Conference on Electrodeposition in Statler Hotel, Boston, Mass., on June 12–15.

American Society for Testing Materials 53rd Annual Meeting and 9th Exhibit of Testing Apparatus and Related Equipment in Chalfonte-Haddon Hall, Atlantic City, N. J., on June 26–30.

Detroit Branch, A. E. S. Annual Stag Day at Forest Lake Country Club near Pontiac, Mich., on July 29.

Industrial Finishes Exhibition at Earle Court, Kensington, London, England on August 30–September 7.

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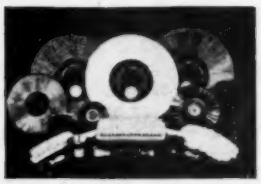

Bear in mind, the finest brush is no good on the wrong type of job. First determine the job to be done. Some work, like heavy brushing and removing burrs, calls for wire brushes. For polishing irregular metal surfaces Tampico brushes are recommended. Some jobs call for brushes of cotton or other materials. H-VW-M makes a complete line . . . tampico, wire, cotton potash, platers' hand brushes, etc., and all are manufactured by skilled craftsmen from uniform materials of the highest quality. For complete details, send for Bulletin BR-104.

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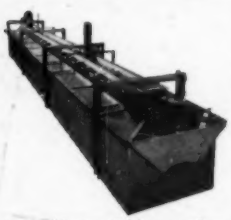

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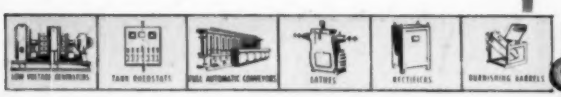

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